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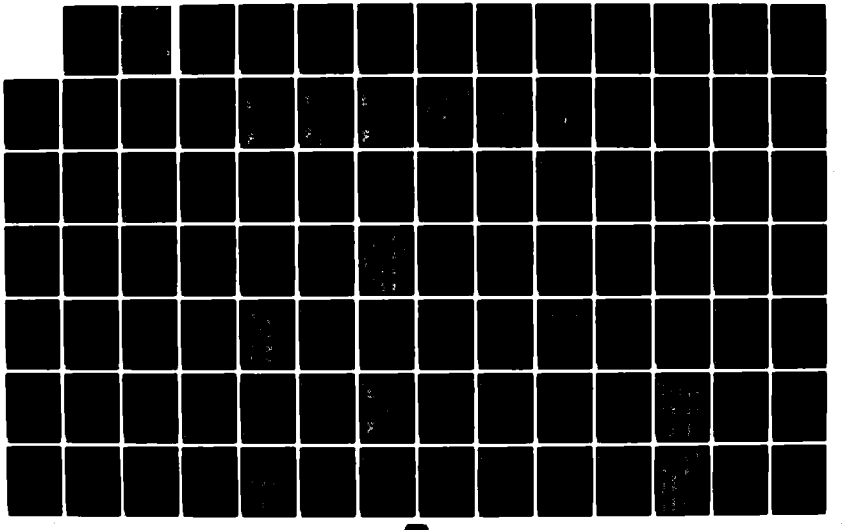

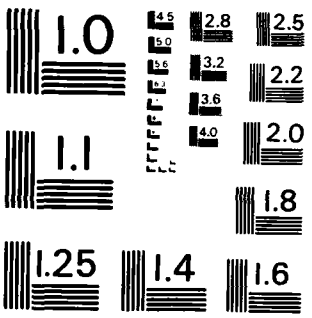

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DESIGN OF A SCIENTIFIC INFORMATION COLLATION AND DISSEMINATION SYSTEM

FINAL TECHNICAL REPORT

VOLUME I

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PREFACE

This project was administered by the Academy for State and Local Government which is directed by Enid Beaumont. The project was conducted under the direction of Gerard J. Hoetmer, Principal Staff Associate and Director of Public Safety Programs, with the International City Management Association. Morris J. Taubenslag, President, TASCQ Services, Inc. provided technical consulting. The research and the final technical report were supported by the Federal Emergency Management Agency under Contract No. EMW-C-0877.

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EXECUTIVE SUMMARY

Perspective

The purpose of this study is to (a) determine the scientific and technological information needs of the emergency management community, and (b) explore the options available to the Federal Emergency Management Agency (FEMA) to coordinate or develop a mechanism to provide this information. The objectives for organizing such an information service are to:

- Provide a reference and referral service of reports and materials that would support the activities of (a) planners within FEMA, (b) planners within other Federal departments and agencies and in state and local governments, (c) scientists and technologists in universities and private sector organizations who support the work of the public sector cadre involved in planning and organizing domestic and national security emergency programs.

- Identify exemplary emergency management programs and disseminate technical descriptions of the composition of these programs so that they may serve as models to other planners.

- Maintain a talent bank resource that would identify scientists and technologists working in emergency management related fields who may be called on to support the public sector planning and organization of emergency programs.

- Establish an information dissemination system that is nationally known, and easily accessible directly and/or through a network, to facilitate the task of finding scientific and technical information that is needed by the practitioner in emergency program issues.

- Establish a system that makes and maintains linkages and communication between entities having the same scientific or technical interests in domestic and national security emergency fields (e.g., foreign and international organizations).

- Provide a technical information resource that ensures the practitioner has access to the most current knowledge in the field when planning and organizing emergency programs. A complementary aspect of this objective is that the use of similar materials would promote a larger degree of commonality in planning, organization, and procedures.

- Establish a system that fosters the Integrated Emergency Management System (IEMS) concept by (a) disseminating planning information on multi-use (all-hazard) modality of response, and (b) institutionalizes programmatic commonality.

Fema's interest in these objectives is dictated by its charter. FEMA must assume responsibility for the organization of such an information system because of its central mission to coordinate emergency management planning activities among all public sector departments and agencies. The public sector departments and agencies outside of FEMA recognize the advantage in having FEMA act as coordinator and facilitator between state and local governments, FEMA regional offices, the Federal agencies, and the White House in the case of a domestic emergency.

It is not believed that this close and special relationship exists between FEMA and the other public sector entities in the long-range emergency planning activities of Federal departments and agencies and in state and local governments. Possibly this is because the external practitioners involved in planning do not see FEMA providing a unique and readily available resource that facilitates the practitioner's job.

Many of the subjects and disciplines covered by the umbrella of emergency management have multiple agency usage or interest. They often involve interagency plans and responses. Effective utilization of the collective knowledge of those involved in emergency management and the efficient dissemination of this knowledge to those in government, universities, and the private sector organizations who need the information requires a unifying principle and champion. The organization of a Scientific and Technical Information System (STIS) would serve such a purpose through the sharing and exchange of emergency management information.

FEMA's central role in coordinating emergency planning and response makes that agency the logical choice to champion the development of an STIS in some form.

In the context of this study's objectives, the STIS is not intended to be an instrument of the Emergency Operations Directorate. Their activities are responsive to immediate emergencies. Plans for their coordinating processes are in place and operational. They have (or will soon have) computer hardware and software to accommodate their programs.

The study is developed on the premise that the STIS is a service -- not a response mechanism. To maintain its service role, it should be kept separated from the Emergency Operations Directorate activities. The STIS should be a tool for planning in SLPS, the National Preparedness Programs Directorate, the Federal Insurance Administration, the Training and Education Directorate, other public sector agencies that are involved in developing policy and planning, and in private sector organizations that support FEMA.

Study Elements and Logic

This study details the findings that justify the organization of an STIS. It suggests optional configurations of an information system. The study also details a cost/service relationship between these options (see Volume III, Appendix A). The tasks that made up the study and progressively focused on the study's conclusions are depicted in Figure 1. A summary, using figure 1 as guide follows.

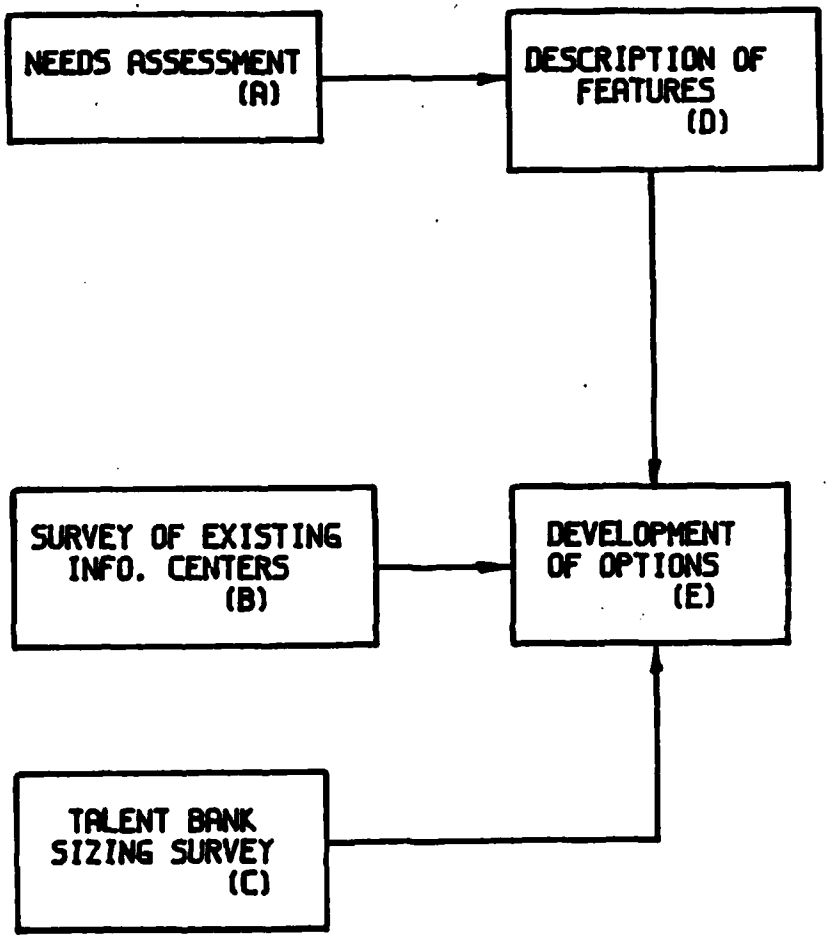

FIGURE 1 STUDY ELEMENTS AND LOGIC

Three external factors are significant considerations in determining the STIS optional configurations. These include:

- o The findings of a needs assessment study (Element A of Figure 1). Developed from interviews of potential users of an STIS or professionals who manage information centers or libraries. Volume II, section 4.1 and Volume III, appendix B of this report details the perceptions of 43 people who were asked about their insights into present and future emergency-related informational needs. If they were custodians of a library system they were queried about the extent of their emergency-related holdings.

- o The findings of a survey of libraries that contain information and material of significance in emergency related fields (Element B of Figure 1). Volume II, section 4.2 of this report (a) enumerates the number of libraries that contain similar classes of emergency related materials, (b) lists the holdings of a sample of these libraries, and (c) lists whether these libraries have an on-line interactive retrieval system. The number of documents in the FEMA library and the number of documents published by FEMA are delineated. The number of emergency related reports that can be extracted using a commercial information system (DIALOG interrogating the NTIS database) via an an on-line terminal was also determined.

- o The findings of a survey to determine the size of a potential talent bank (Element C of Figure 1). Specialists at FEMA and other Federal facilities in emergency related fields were queried on their perception of the number of experts in their field of specialization. Volume II, section 4.3 reports on the survey results.

The needs assessment, surveys of material resources, evaluation of the talent bank configuration and the description of system features (see matrix key on p. 12) describe the information system requirements. The level of incorporation of these requirements determines the parameters of the proposed STIS design. Figure 2 diagrams a design selection methodology that presents the difference between the potential system options. The selection methodology is pictured as a logic tree which branches on decisions based on (a) the method of service delivery and (b) the level and type of service and products.

The logic of the design selection methodology poses the first decision element - should the STIS be manual or automated? If manual, then two optional configurations may be assued.

Option 1 - Referral Service - Manually Operated

Option 2 - Manual Referral and Library Service

If the decision is to automate the STIS, Figure 2 suggests that a second decision must be made. Is the automated system to be centralized or decentralized? If centralized, two optional configurations must be assumed:

Option 3 - Automated Stand-Alone STIS

Option 4 - Central System - Star Network

If the automated system is decentralized, two other optional configurations must be assumed:

Option 5 - Decentralized STIS - Dendridic Network

Option 6 - Decentralized STIS - Coordinated Network

There are obvious variations and combinations to these configurations. In the main, however, the principles required to design the basic systems suggested by Options 1-6 would consider potential configurations.

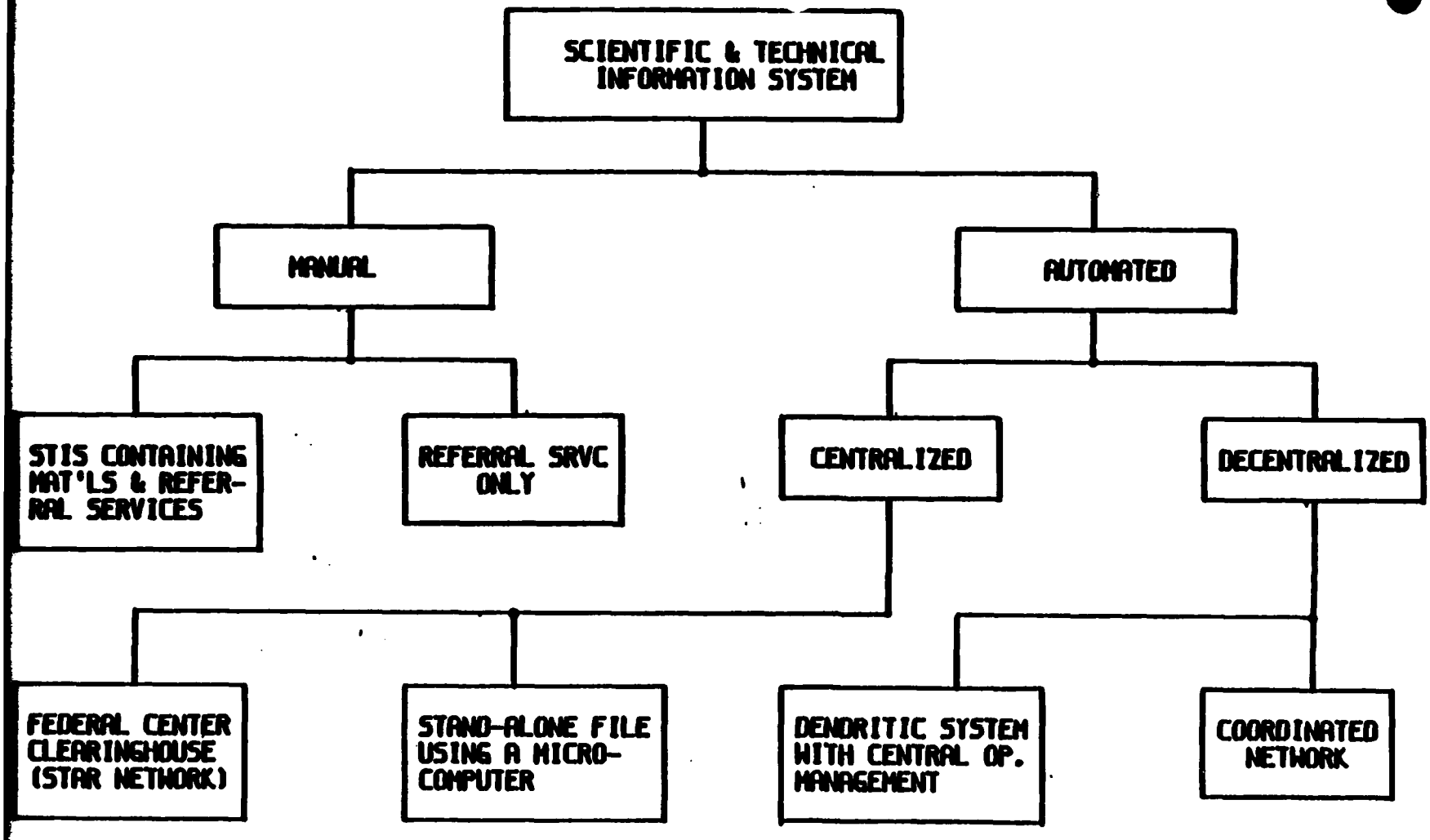

FIGURE 2 SCIENTIFIC AND TECHNICAL INFORMATION SYSTEM SELECTION TREE

System Design Concepts

The structured objectives that form the guidelines for the system design concepts are paraphrased as follows:

- Provide details of the parameters of the optional designs of the FEMA STIS. The primary purposes of such designs are to organize a facility that can coordinate and manage FEMA informational assets (Objective 1).

- Develop a plan to ensure access and interchange among FEMA controlled and FEMA supported informational elements (Objective 2). The criteria for success in achieving a workable plan will be in the ability to (a) obtain use of complementary, rather than redundant, informational assets and (b) develop standardized methods for collecting, processing, and retrieving the individual information bases so that there is efficiency in the informational interchange.

- Develop a plan to include informational assets which exist outside of FEMA into the planned STIS (Objective 3). The criteria for success in achieving this objective will be similar to those of Objective 2.

- Detailed methods to implement a rapid response interactive system to provide FEMA staff and other potential users with hazards and emergency-related scientific and technical information (Objective 4). The criteria for success in achieving this objective will be measured by (a) the degree of informational detail that can be obtained by the rapid response interactive system, (b) the degree of use that the response system makes of external information resources, (c) the number of users that can be accommodated at the same time by the planned STIS, and (d) the extent of the other classes of users (other Federal agencies' personnel, state and local government administrators and practitioners, public sector consultants, etc.) that are serviced by the system.

The objectives of the options are similar. They all propose to serve, to some degree, as an information linkage mechanism that informs practitioners, administrators, and researchers about programs, resources, practices, and findings in hazards and emergency related areas. The differences in the options are in how they are (a) philosophically structured to meet these objectives and (b) physically structured to support the philosophical concept. The first attribute

considers whether the STIS is to be centralized or decentralized. It also considers the level of coordination to be provided by FEMA to integrate a national information system in emergency related fields. The second attribute considers the equipment and staff required to implement the STIS.

The attributes of the options determine whether the STIS is to be an information center or a clearinghouse. The difference between the two structures is in (a) the level of subject material collection, (b) the extent of information processing, retrieval, and dissemination, (c) the amount of client support that is provided, and (d) the central position of the facility as an information source. In its simplest form, an information center acts simply as a facilitator to support a user in obtaining information. As such, it usually contains a generalized database of information about programs, subject experts, and sources of published material. The existing, or available, database may not even have been developed at the information center. The database is primarily used as a reference and referral guide to materials and resources located at other facilities.

A clearinghouse, on the other hand, has a greater base of activities, a higher level of response to clients, and is recognized as a primary information source on a topical subject. Distinctive features are that:

- The clearinghouse is focused on a specific subject area and targeted audience. Information is not collected on all topics.
- The clearinghouse engages in the acquisition of literature-based information related to its focused area as well as maintains a database representing records of the literature-based resources. (The term "literature" is defined to include nonpublished materials, audio-visual materials, descriptions of organizations and talent resources, etc.) The STIS clearinghouse would thus contain (a) an in-house computerized database on emergency related subjects that would complement existing commercial and other Federal agencies' computerized databases, (b) fugitive files on unpublished reports and articles, (c) shelved materials, and (d) talent bank information.

- The clearinghouse processes the acquired information into a collection with an index and other tools to permit systematic search and access. (These tools do not have to be in a computer-readable form.)

- The clearinghouse solicits inquiries and establishes minimal requirements in the form of the inquiry. It is willing and able to accept inquiries made in person, by phone, or by letter. It responds to inquiries in a nonstandard fashion, if necessary.

- The clearinghouse must be willing and able to conduct systematic searches of its information collection beyond that available in the published literature collection. Thus as a process facilitator, the clearinghouse supports a topic research by providing an analytical component to go with the search component as a means of integrating the findings of published and unpublished reports and articles on a specific subject.

As there are differences, there are also similarities in the logic of organizing and delivering information services of seemingly diverse STIS options. This is true whether they are structured as information centers or clearinghouses. All the STIS options must organize some procedures for efficiently interfacing with their clients. They may also utilize similar logic and concepts of material collection. Similarities may extend to methods of information cataloging and indexing, and levels of interactive support. The point that is being made is that the differences in the options tends to be in (a) the degree of service that FEMA wishes to provide in a central facility at FEMA and (b) the level of informational support obtainable from an STIS.

Figure 3 depicts the components of all of the optional configurations. The key to interpret the matrix follows on the next page. It describes the codes that indicate the various system services, users, coordination and management tasks. The diagram for each option are included as Figures 4, 5, 6, 7, 8 and 9. A more detailed discussion of each option and of these elements can be found in Volume II, section 5.0

FIGURE 3 MATRIX OF SYSTEM OPTIONS

STIS OPTIONS	STIS SERVICES	STIS USERS	STIS OPERATING REQUIREMENTS: COORDINATION TASKS	STIS OPERATING REQUIREMENTS: MANAGEMENT TASKS	STAFFING	SPACE (sq. ft.)	STIS COSTS: START-UP	STIS COSTS: ANNUAL OPERATIONS
1. **Referral Service - Manually Operated** A reference and referral service maintaining and catalog files on (a) sources and types of emergency related materials available in existing libraries and (b) sections of supporting agencies and consulting talent who have specialized knowledge in emergency related areas.	A_2, A_3	C_1, C_2, C_3, C_4, C_6	-	D_1, D_2	2-professionals 1-support	400	$ 93,000	$ 86,000
2. **Manual Referral and Library Service** A reference and referral service as in option 1 but augmented by a collection of scientific and technical published materials and FEMA generated reports. This collection would supplement the present holdings and be part of the FEMA Library.	A_2, A_3	C_1, C_2, C_3, C_4, C_6	-	D_1, D_2, D_6	3-professionals 1-support	1,000	$130,000	$118,000
3. **Automated Referral Service** A reference and referral service maintaining on a stand-alone microcomputer (a) sources and types of emergency related materials available in existing libraries and (b) sections of supporting agencies and consulting talent who have specialized knowledge in emergency related areas. The computer would also be used as a terminal to retrieve commercial database information.	A_1, A_2, A_3	C_1, C_2, C_3, C_4, C_6	-	D_1, D_2	3-professionals 1-support	400	$135,000	$128,000
4. **Central System - Star Network** A central repository of all emergency related reports and materials. It would be responsible for collecting all relevant information and material from all known sources and electronically cataloging the content of this information. This STIS will not duplicate information that already exists in abstracted form but will contain reference and referral information on the contents of the bibliographic documents and materials in the other computerized databases.	$A_1, A_2, A_3, A_4, A_5, A_6, A_7$	$C_1, C_2, C_3, C_4, C_5, C_6, C_7$	B_1, B_2, B_4, B_6	$D_1, D_2, D_3, D_4, D_5, D_6, D_7, D_8, D_9, D_{10}$	13-professionals 5-support	2,800	$479,500	$467,000
5. **Decentralized - Dendritic Network** A nationally centralized system as in option 4 except that the computerized database would be provided to regional centers and to other Federal agencies either as magnetic disks or through electronic networks. The branching network would provide on-line search and referral services; the central STIS would provide desired hard copy and support research.	$A_1, A_2, A_3, A_4, A_5, A_6, A_7$	$C_1, C_2, C_3, C_4, C_5, C_6, C_7$	$B_1, B_3, B_4, B_5, B_6,$	$D_1, D_2, D_3, D_4, D_5, D_6, D_7, D_8, D_9, D_{10}$	11-professionals 5-support 10-regional staff	2,800 (core) 400 per region	$438,000 (core and 2 regional centers only)	$632,000 (core and 2 regional centers only)
6. **Decentralized - Coordinated Network** A consortium of information centers. Each member would specialize in one technical area. Their responsibility would be to collect and electronically process information in their chosen field. The processed information would be available to all the nodes in the system. Each node would service the users that contact that facility. FEMA would serve as a node in the system and would chair a coordinating process to standardize the information gathering, information processing, quality control, user interface, methodology, etc. used by all information centers.	$A_1, A_2, A_3, A_4, A_5, A_6, A_7$	$C_1, C_2, C_3, C_4, C_5, C_6, C_7$	B_1, B_2, B_3, B_4, B_6	$D_1, D_2, D_3, D_4, D_5, D_6, D_7, D_8, D_9, D_{10}$	11-professionals 5-support	2,800	$460,000	$440,000

KEY TO STIS OPTION MATRIX

Code	
A.1	On-line search of published documents
A.2	Referral to other databases and services
A.3	Provision of resource and talent information
A.4	Provision of periodic bulletins/newsletter
A.5	Provision of electronic mail
A.6	Provision of hardcopy/microfiche/magnetic tapes
A.7	Research of fugitive files and all databases to prepare a report on a scientific subject of interest to a user of the STIS
B.1	Organize national guidelines for emergency management information methodology and exchange
B.2	Organize a universal lexicography for an emergency management reference system
B.3	Organize an emergency management information network with public sector and university facilities modes
B.4	Organize an electronic mail network
B.5	Set up, train, and provide support for regional satellites of an STIS
B.6	Organize a process of inforaational exchange between Federal agencies and technical information centers
C.1	FEMA Personnel
C.2	Other Federal agencies' emergency management planners
C.3	Other Federal agencies' professional staff
C.4	State and local government emergency management planners and practitioners
C.5	Other State and local government officials
C.6	Researchers
C.7	Graduate students
C.8	The general public
D.1	Collect talent bank information and maintain the file
D.2	Organize and keep an information exchange between other public sector agencies active
D.3	Collect materials (abstracts, reports, books)
D.4	Develop criteria for (a) entry to databases, (b) storage in fugitive files, (c) material elimination, etc.
D.5	Set up information retrieval system
D.6	Set up library of (a) hardcopies, (b) vertical file, (c) microfiche, etc.
D.7	Catalog, index, and abstract D.4 materials
D.8	Process and edit D.7 materials
D.9	Set up and maintain material dissemination process
D.10	Organize and operate a self-evaluative system to dynamically improve the STIS

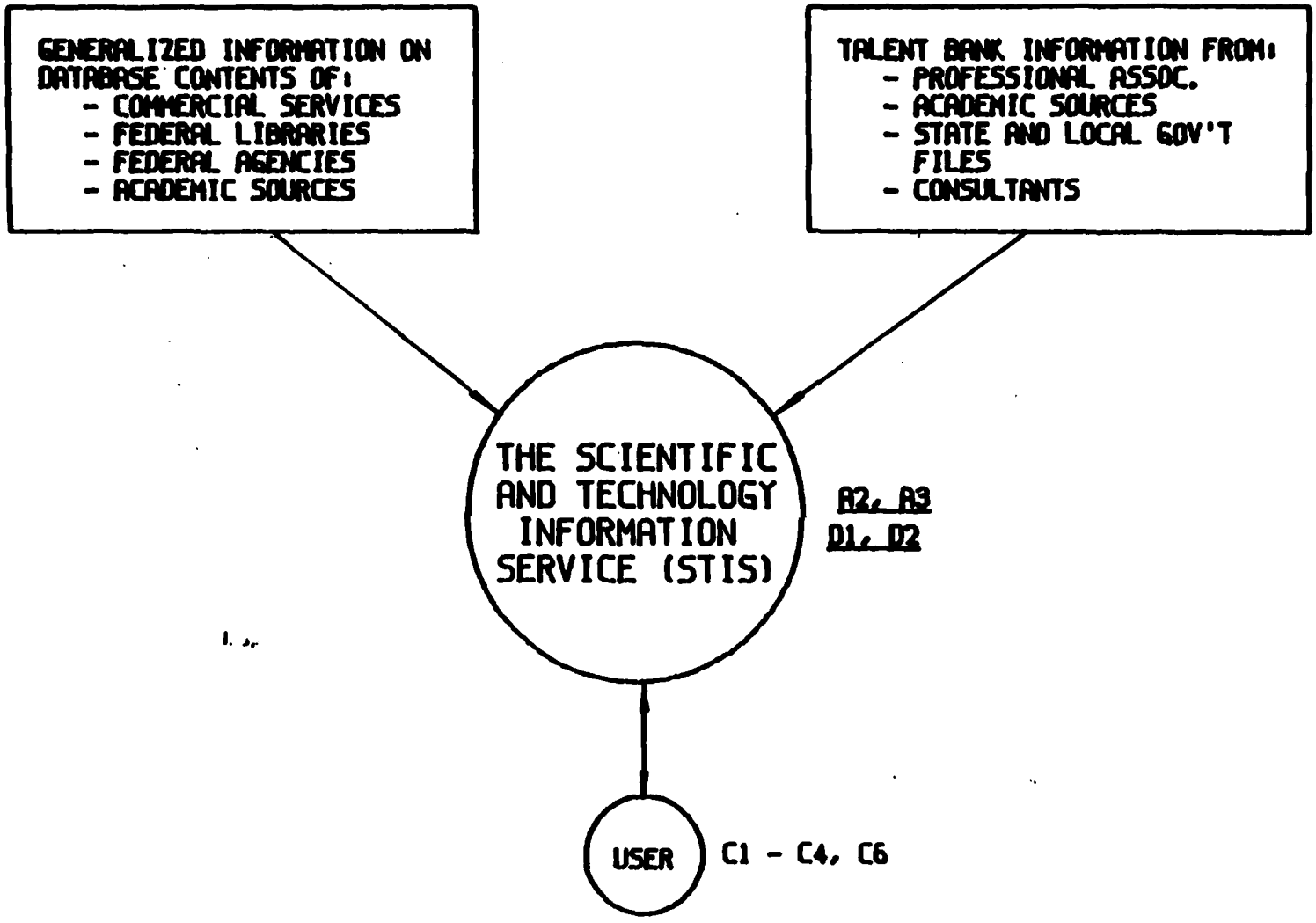

FIGURE 4 REFERRAL SERVICE - MANUALLY OPERATED

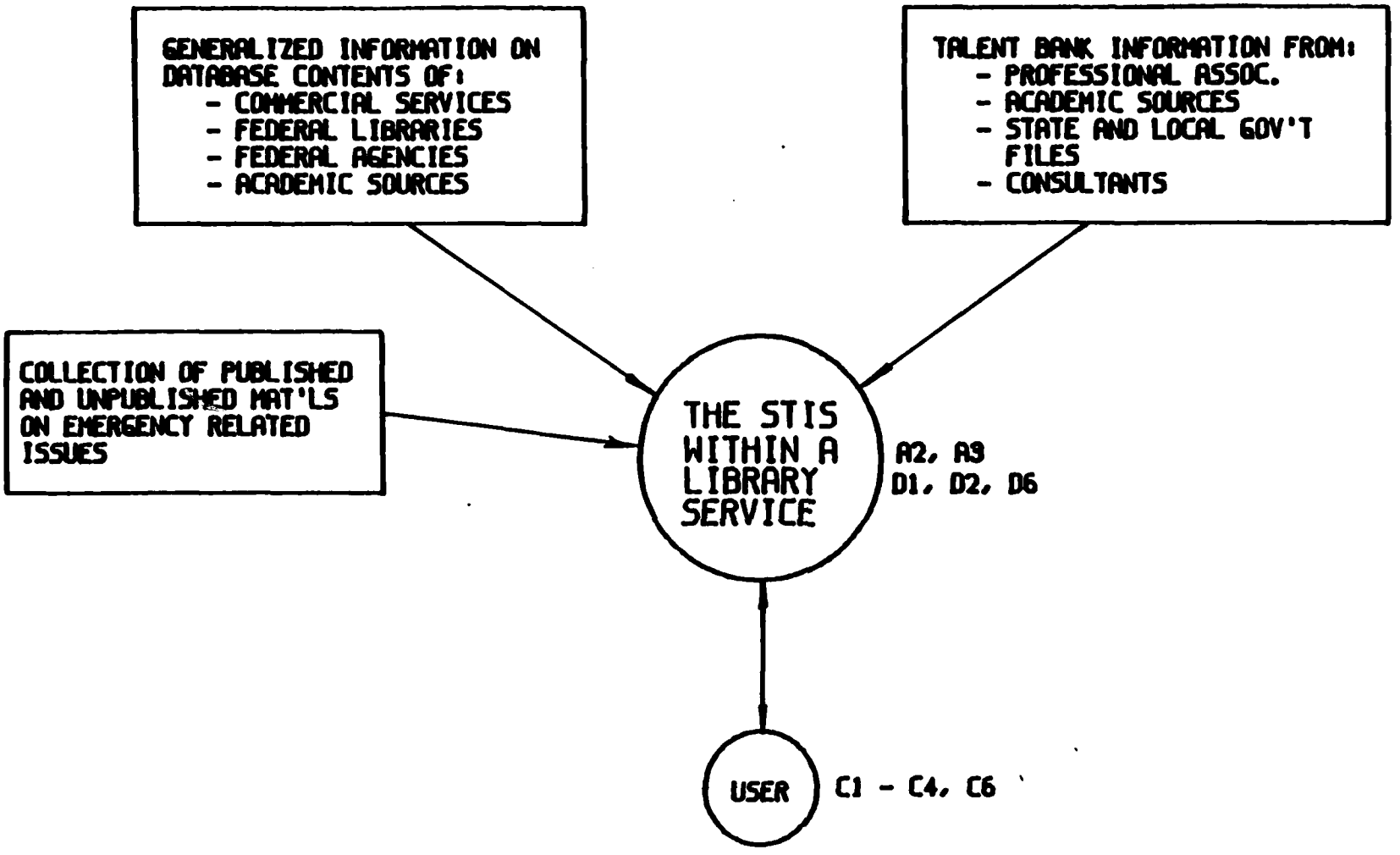

FIGURE 5 MANUAL REFERRAL & LIBRARY SERVICE

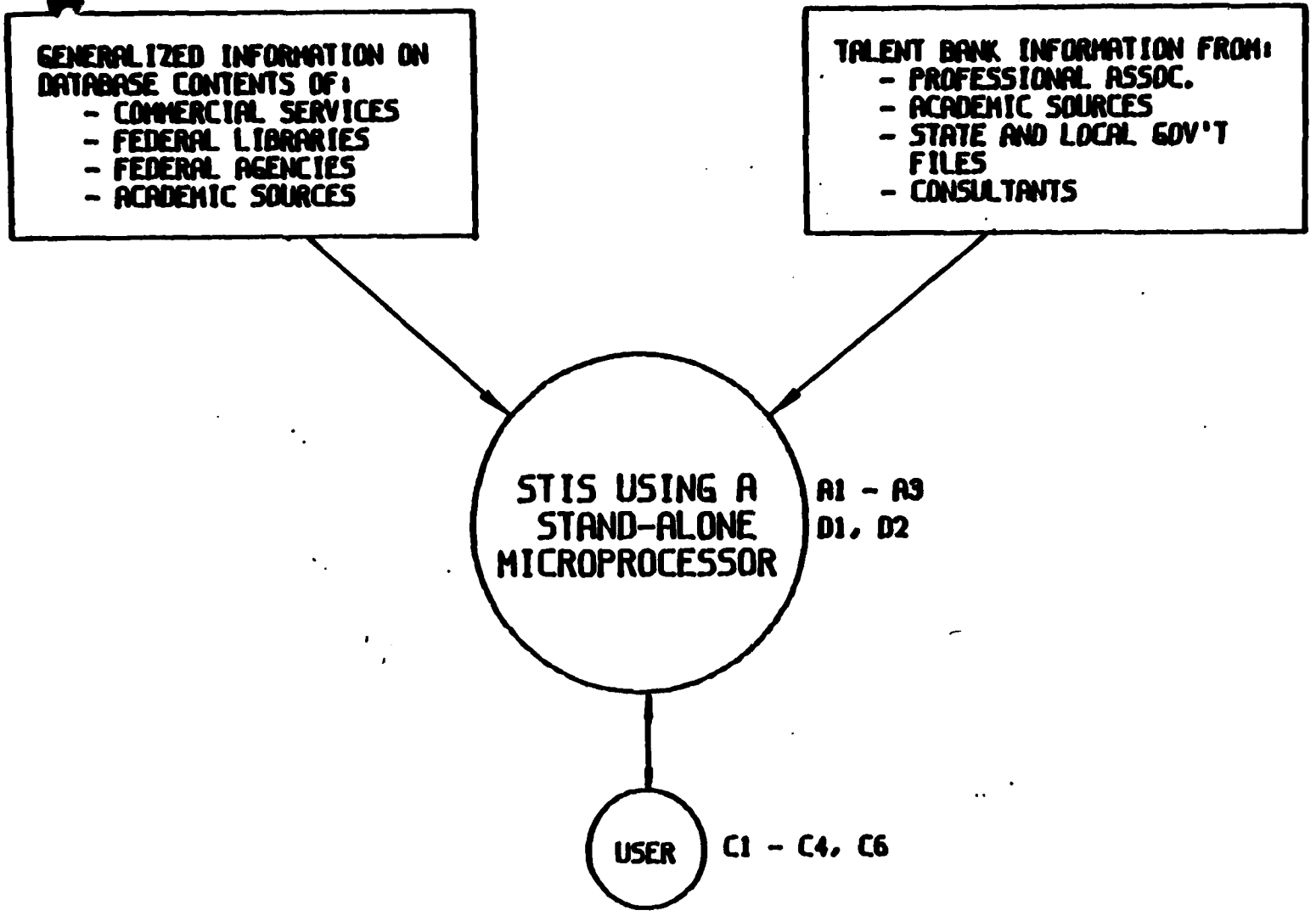

FIGURE 6 AUTOMATED STAND-ALONE STIS

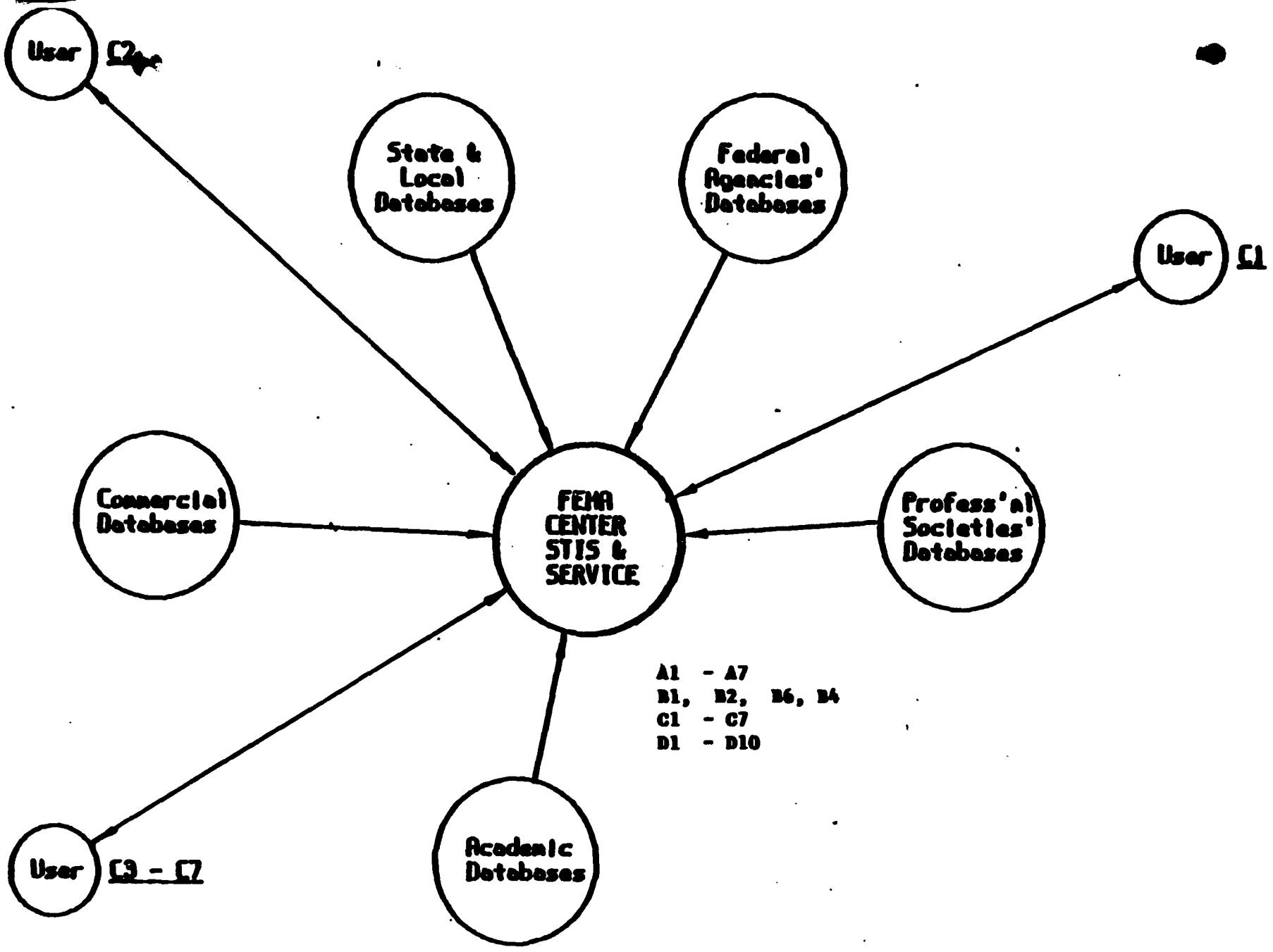

FIGURE 7

CENTRAL SYSTEM - STAR NETWORK

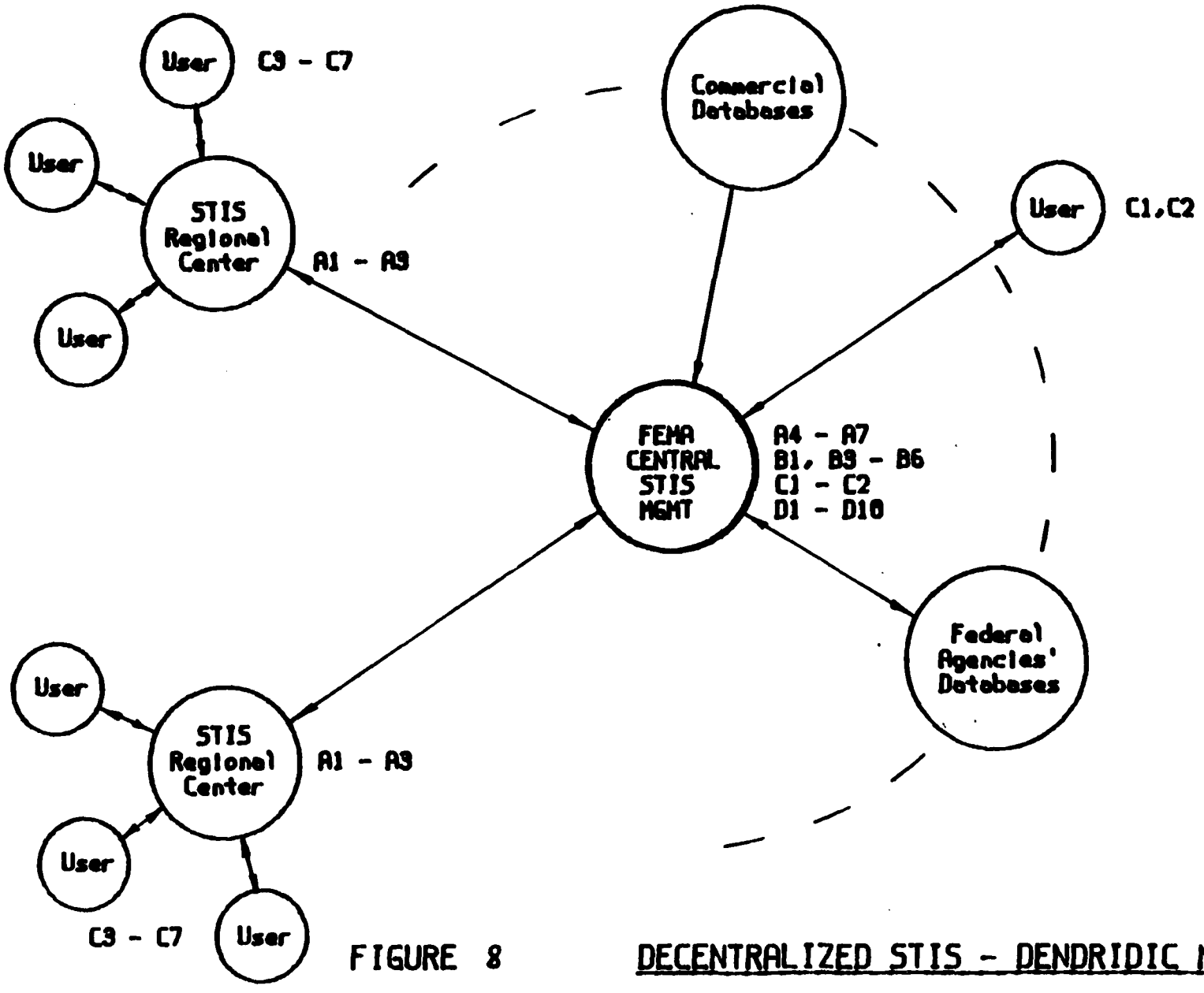

FIGURE 8 DECENTRALIZED STIS - DENDRIDIC NETWORK

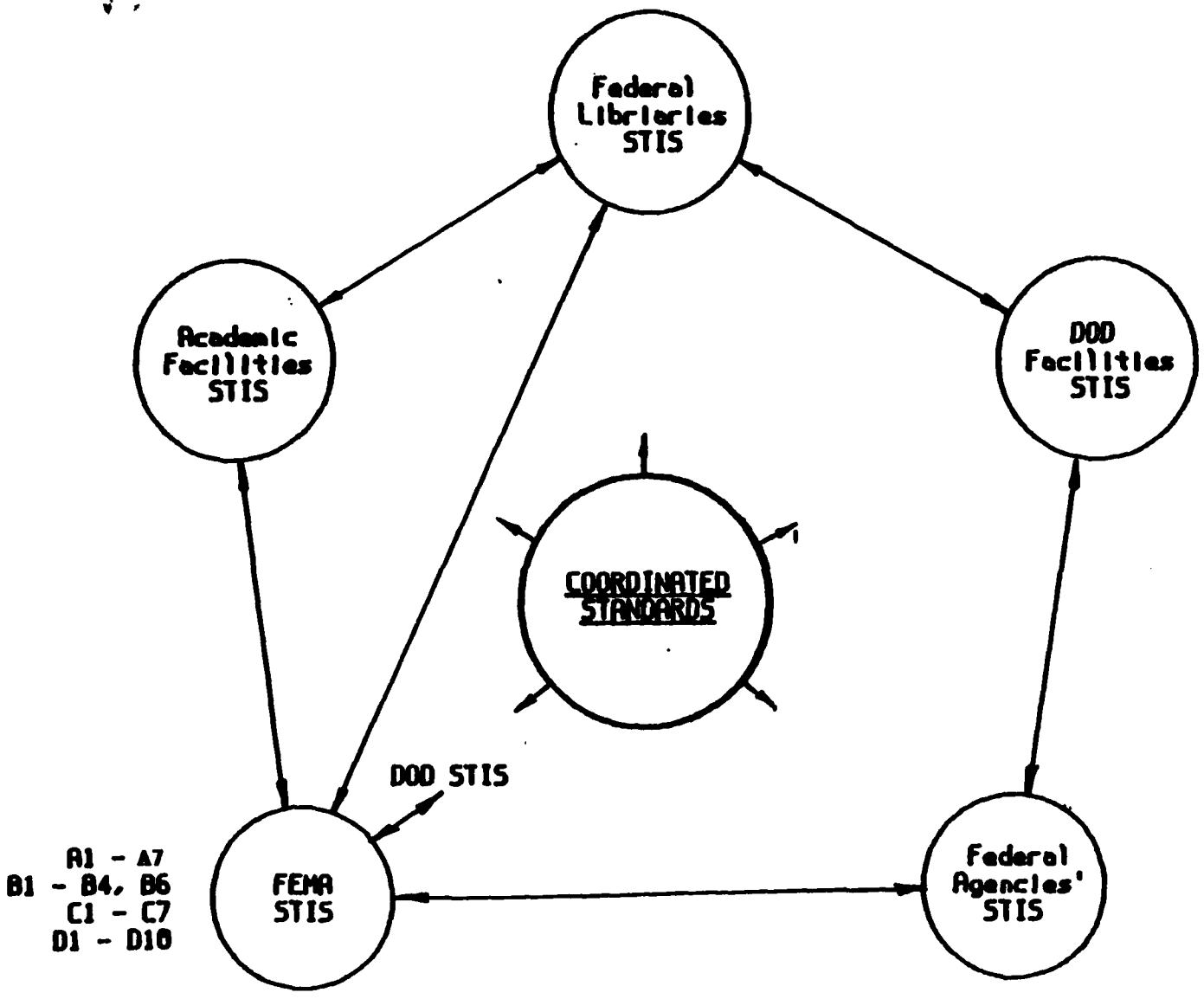

FIGURE 9 DECENTRALIZED STIS - COORDINATED NETWORK

CONCLUSIONS AND RECOMMENDATIONS

This portion of the report provides a series of conclusions and recommendations to assist FEMA in establishing an STIS. They are distilled from the entire report.

Three external components were significant in determining the STIS configurations discussed in section 5.0.

1. A needs assessment study detailing the perceptions of potential STIS users and professionals who manage information centers or specialized libraries (see Volume II, section 4.1 and Appendix B).

2. A survey of libraries that contain information and materials of significance in emergency management and related fields (see Volume II, Section 4.2 and Appendix B).

3. A survey to determine the size of a talent bank (see Volume II, section 4.3.

In addition to the direction that these three study components provided each one of the six STIS configurations have inherent structural strengths and weaknesses. All of the above provide a basis for the following conclusions and recommendations.

CONCLUSIONS

The following section summarizes the project's findings.

1. There is a near unanimous felt need and urgency among those interviewed for the establishment of an STIS.

2. There is a high level of consensus among those interviewed that FEMA must take a lead coordinative role in the establishment of an STIS.

3. The breadth and complexity of emergency management and the related emergency management fields makes an information system designed as a coordinative network essential.

4. The specialized libraries visited are amenable to a coordinative STIS. The holdings of the FEMA libraries, NBS Center for Fire Research, Disaster Research Center, Center for Technology Environment and Development and the Natural Hazards Research and Applications Information Center could provide the core nodes of an STIS.

5. Time is of the essence. Unless FEMA moves quickly its preeminent role as a potential coordinator of an STIS will vanish and other organizations such as the specialized libraries (CENTED, NHRAIC) or other federal agencies (EPA, DOT) will either seize the initiative or head in their own direction making a latter coordination effort very difficult.

6. The complexity of FEMA's many roles and missions and its intricate and delicate relationships with other federal agencies and departments makes an STIS an imperative if FEMA is to gain control and direction of its own research and development efforts.

7. FEMA is currently unable to respond effectively to a large number of emergency management inquiries it receives. This situation can only worsen as FEMA's Integrated Emergency Management System becomes fully operational and as FEMA continues to successfully expand the interest in emergency management to other professional groups (e.g., public administration community).

8. An internal FEMA "champion" must be found for the STIS. He/she must be fully supported by the highest levels of FEMA management. Only with high level support can an STIS become fully operational within the very diversified FEMA directorates.

9. The Federal Laboratory Consortium for Technology Transfer must be considered an important element in any STIS.

10. Presuming a coordinative network is established, the expert resource file (talent bank) of the STIS should be structured as a dual system, with (1) a listing of particular areas of major concern in which a half dozen experts would be identified and (2) a series of access pathways via the various nodes of the STIS that would identify other skills and have access to the broader categories.

RECOMMENDATIONS

This final section discusses the project's recommendations. These recommendations are based on the study's conclusions and the other findings summarized in the report.

Recommendation 1 - FEMA should immediately initiate the development of a Scientific and Technical Information System (STIS) via a simultaneous two track implementation process. The objective of the first track would be the establishment of an automated referral and library service through the organizational framework of the FEMA libraries (see system design options 2 and 3 in section 5.0). Simultaneously, the second track would have as its objective the establishment of a consortium for the development of a decentralized STIS - coordinated network (see system design option 6 in section 5.0).

Recommendation 2 - The establishment of an automated referral and library service should proceed and be linked under the longer term umbrella objective of establishing a decentralized STIS - coordinated network.

The FEMA automated referral and library service should have two centers (and thus FEMA would have two nodes within the consortium's coordinated network). The first should be established at FEMA's Information Resource Management Library, the second, a satellite of the first, at FEMA's NETC Learning Resource Center.

The two centers would differ (as with the other nodes or members of the consortium) by their areas of expertise. The NETC Learning Resource Center should continue to specialize in the practical application questions related to fire department operations, hazardous materials, code administration and enforcement, etc. The Information Resource Management Library should begin specializing in the more highly technical and research oriented domestic and national security emergency fields such as industrial protection, etc.

The two FEMA centers would also differ in their level of service. To avoid duplication and to foster the development of strong linkages and communication between the centers the NETC Learning Resource Center would be dependent upon the clearinghouse functions of the Information Resources Management Library.

Recommendation 3 - The number of organizations invited to participate in the coordinated network should initially remain small to actuate the agreement process and the formal establishment of the consortium. It is recommended that the core members of the network should include the following organizations:

- The National Bureau of Standards Center for Fire Research;

- The Disaster Research Center (shortly to be housed at the University of Delaware);
- The Center for Technology, Environment and Development, Clark University;
- The Natural Hazards Research and Applications Information Center, University of Colorado; and,
- The two FEMA resource Centers.

These core members have the ability to cover in general the wide spectrum of subject areas in emergency management. Upon the establishment of the consortium, FEMA, as chair organization, can use the strength of the consortium to induce other federal agencies to participate, e.g. EPA, DOT, USGA.

Recommendation 4 - Upon the establishment of the consortium, FEMA should take the central role in organizing the standardization process for the coordinated network. FEMA should (a) chair the standardization committee, (b) set the agenda and schedule of coordinating meetings (c) work closely with task groups defining details of the system (d) provide resources to develop a common lexicon (e) provide funding for automating the resources in the smaller, highly specialized libraries of the consortium (f) prepare detailed plans, cost analyses, and non-technical reports of the network concept and its benefits to promote it to other federal agencies and libraries.

Recommendation 5 - The management of an expert talent resource file should be central to the functioning of the coordinated STIS and should operate on a two-tiered basis, one formal and one informal. The formal tier should be automated (see Volume II, section 4.3.

and consist of a small number (under 1,000) of key specialists and transfer agents. For example, each one of the approximately 90 subject specialists that work for the NBS Center for Fire Research should be included in the formal tier of the talent bank. The cadre of experts that are known by these specialists in their various fields would be considered a part of the informal network. Currently, each one of the recommended core organizations of the proposed consortium uses an informal expert referral system. The Natural Hazards Research and Applications Information Center, for example, uses the list of invitees to the annual Natural Hazards Research Workshop. These persons are personally known by the Center's staff and have a wide access to others in the field.

Recommendation 6 - The formal tier of the expert file should remain highly exclusive. Only those persons professionally known by the organizations in the network as individuals with a high level of expertise or information transfer agents who have a particularly wide array of professional contacts in the relevant fields should be included. This standard of excellence will help persuade expert talent to participate. The expert file should be voluntary and be developed through the informal systems currently employed by the potential network organizations. Formal standards for acceptance into the file should be established by the core network members upon the establishment of the consortium. Finally, any financial arrangements to obtain the services of these experts or the cadre of others informally referred would be the responsibility of the user.

DESIGN OF A

SCIENTIFIC INFORMATION COLLATION AND

DISSEMINATION SYSTEM

FINAL TECHNICAL REPORT

VOLUME II

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PREFACE

This project was administered by the Academy for State and Local Government which is directed by Enid Beaumont. The project was conducted under the direction of Gerard J. Hoetmer, Principal Staff Associate and Director of Public Safety Programs, with the International City Management Association. Morris J. Taubenslag, President, TASCQ Services, Inc. provided technical consulting. The research and the final technical report were supported by the Federal Emergency Management Agency under Contract No. EMW-C-0877.

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DESIGN OF A

SCIENTIFIC INFORMATION COLLATION AND DISSEMINATION SYSTEM

SECTION I

BACKGROUND AND USER REQUIREMENTS

DESIGN OF A
SCIENTIFIC INFORMATION COLLATION AND DISSEMINATION SYSTEM

1.0 PURPOSE

The purpose of this study is to (a) determine the scientific and technological information needs of the emergency management community and (b) explore the options available to the Federal Emergency Management Agency (FEMA) to coordinate or develop a mechanism to provide this information. The objectives for organizing such an information service are to:

- Provide a reference and referral service of reports and materials that would support the activities of (a) planners within FEMA, (b) planners within other Federal departments and agencies and in state and local governments, (c) scientists and technologists in universities and private sector organizations who support the work of the public sector cadre involved in planning and organizing domestic and national security emergency programs.

- Identify exemplary emergency management programs and disseminate technical descriptions of the composition of these programs so that they may serve as models to other planners.

- Maintain a talent bank resource that would identify scientists and technologists working in emergency management related fields who may be called on to support the public sector planning and organization of emergency programs.

- Establish an information dissemination system that is nationally known, and easily accessible directly and/or through a network, to facilitate the task of finding scientific and technical information that is needed by the practitioner in emergency program issues.

- Establish a system that makes and maintains linkages and communication between entities having the same scientific or technical interests in domestic and national security emergency fields (e.g. foreign and international organizations).

- Provide a technical information resource that ensures the practitioner has access to the most current knowledge in the field when planning and organizing emergency programs. A complementary aspect of this objective is that the use of similiar materials would promote a larger degree of commonality in planning, organization, and procedures.

- Establish a system that fosters the Integrated Emergency Management System (IEMS) concept by (a) disseminating planning information on multi-use (all-hazard) modality of response, and (b) institutionalizes programmatic commonality.

FEMA's interest in these objectives is dictated by its charter. FEMA must assume responsibility for the organization of such an information system because of its central mission to coordinate emergency management planning activities among all public sector departments and agencies. A model of such exemplary coordination methodology exists at FEMA. Presently, through the State and Local Programs and Support Directorate (SLPS), and the National Preparedness Program, FEMA has a unique relationship with other Federal departments and agencies in coordinating immediate responses to emergencies. The public sector departments and agencies outside of FEMA recognize the advantage in having FEMA act as coordinator and facilitator between state and local governments, FEMA regional offices, the Federal agencies, and the White House in the case of a domestic emergency.

It is not believed that this close and special relationship exists between FEMA and the other public sector entities in the long range emergency planning activities of Federal departments and agencies and in state and local governments. Possibly this is because the external practitioners involved in planning do not see FEMA providing a unique and readily available resource that facilitates the practitioner's job. How can this be remedied in a manner that serves the practitioner? The answer must be in helping provide materials that simplify planning tasks. The organization of a scientific and technical information system can help in serving this purpose.

2.0 BACKGROUND

Executive Orders 12148 and 11490 organized the Federal Emergency Management Agency (FEMA) and assigned FEMA the role of coordinating national preparedness programs, respectively. Under these authorities FEMA is responsible for planning and augmenting such national security programs as:

- Civil Defense Programs that plan and organize for (1) population protection in the event of a national security crisis, (2) communications and warning systems to alert the general population in the event of a national security emergency, (3) general public training and education in matters dealing with civil defense preparations, and (4) industrial protection as an element of preparedness during emergencies.

- Government Operations Programs to (1) ensure continuous operation of essential government functions, (2) organize timely and effective transition to emergency government operation, and (3) ensure that government officials are capable of responding to emergency conditions.

- Industrial Mobilization Programs that (1) improve the capability of industry to meet mobilization requirements, (2) increase the capability of industry to meet national security needs, and (3) assess the impact of the industrial mobilization programs.

- Economic Stabilization and Public Finance Programs to (1) minimize economic dislocations due to national security emergencies, (2) facilitate resource allocations in the event of a population relocation, (3) assure equitable distribution of consumer goods, (4) provide for protection of U.S. financial resources, (5) preserve and facilitate operations of public and private financial institutions, and (6) provide the government with revenue-raising powers to stabilize the economy in the emergency period.

In addition, there are over 100 federal laws that authorize federal agencies to respond to domestic emergencies and provide assistance to state and local governments. The laws, in which FEMA takes a lead and that affect FEMA's coordinating role, include the following:

- National Security Act of 1947.
- Civil Defense Act of 1950, as amended.
- Disaster Relief Act of 1974.
- Earthquake Hazards Reduction Act of 1977.
- The National Flood Insurance Act of 1968.
- Urban Property Protection and Reinsurance Act.
- Federal Fire Prevention and Control Act of 1974.

These executive orders and laws are listed to indicate the extent of technical and scientific subjects and disciplines that are involved and to emphasize FEMA's role in coordinating the planning and response of

both domestic and national security emergencies. The first factor suggests that knowledge of the disciplines within emergency management needs to be harnessed by some mechanism(s) so that the knowledge is efficiently transmitted to planners and researchers within FEMA, other Federal departments and agencies, state and local governments, universities, and private sector organizations involved in emergency issues.

Many of the subjects and disciplines covered by the umbrella of emergency management have multiple agency usage or interest. They often involve interagency plans and responses. Effective utilization of the collective knowledge of those involved in emergency management and the efficient dissemination of this knowledge to those in government, universities, and the private sector organizations who need the information requires a unifying principle and champion. The organization of a Scientific and Technical Information System (STIS) would serve such a purpose through the sharing and exchange of emergency management information. It could serve as a system that would:

- Provide needed scientific, technical, or talent resource guidance to the user of the information system.
- Be responsive to a range of scientific and technical emergency management topics.
- Insure a source of current emergency management information in a variety of areas for all practitioners and researchers.
- Network information between widely separated public sector departments and agencies to effect planning coordination.

FEMA's central role in coordinating emergency planning and response makes that agency the logical choice to champion the development of an STIS in some form.

In the context of this study's objectives, the STIS is not intended to be an instrument of the Emergency Operations Directorate. Their activities are responsive to immediate emergencies. Plans for their coordinating processes are in place and operational. They have (or will soon have) computer hardware and software to accommodate their programs.

The study is developed on the premise that the STIS is a service--not a response mechanism. To maintain its service role, it should be kept separated from the Emergency Operations Directorate activities. The STIS should be a tool for planning in SLPS, the National Preparedness Programs Directorate, the Federal Insurance Administration, the Training and Education Directorate, other public sector agencies that are involved in developing policy and planning, and in private sector organizations that support FEMA.

3.0 SCOPE

The study details the findings that justify the organization of an STIS. It suggests optional configurations of an information system. The study also details a cost/service relationship between these options.
The tasks that made up the study and progressively focused on the study's conclusions are depicted in Figure 3.0-1. A summary, using Figure 3.0-1 as a guide follows.

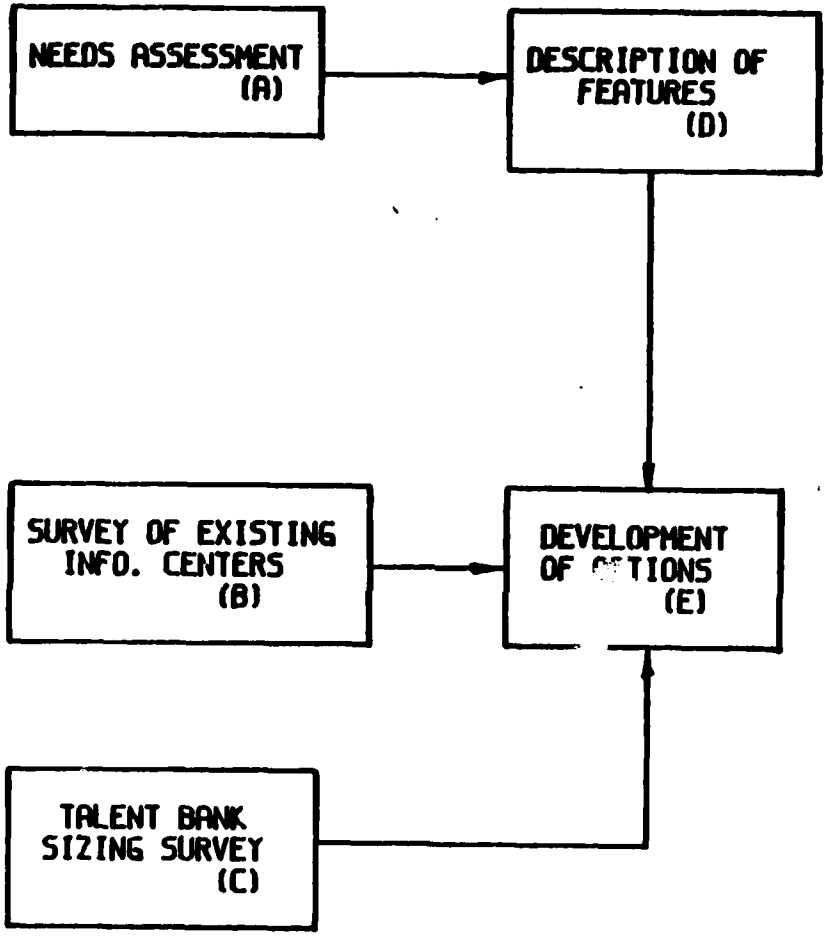

FIGURE 3.0-1 STUDY ELEMENTS AND LOGIC

Three external factors are significant considerations in determining the STIS optional configurations. These include:

- The findings of a needs assessment study (Element A of Figure 3.0-1). Developed from interviews of potential users of an STIS or professionals who manage information centers or libraries, Section 4.1 of this report details the perceptions of 43 people who were asked about their insights into present and future emergency-related informational needs. If they were custodians of a library system they were queried about the extent of their emergency-related holdings.

- The findings of a survey of libraries that contain information and material of significance in emergency related fields (Element B of Figure 3.0-1). Section 4.2 of this report (a) enumerates the number of libraries that contain similiar classes of emergency related materials, (b) lists the holdings of a sample of these libraries, and (c) lists whether these libraries have an on-line interactive retrieval system. The number of documents in the FEMA library and the number of documents published by FEMA are delineated. The number of emergency related reports that can be extracted using a commercial information system (DIALOG interrogating the NTIS database) via an on-line terminal was also determined.

- The findings of a survey to determine the size of a potential talent bank (Element C of Figure 3.0-1). Specialists at FEMA and other Federal facilities in emergency-related fields were queried on their perception of the number of experts in their field of specialization. Section 4.3 reports on the survey results.

3.1 SELECTIVE STIS FEATURES

The needs assessments and surveys of available material and human resources are significant in formulating the STIS options and in establishing criteria for weighing the benefits of optional STIS configurations. Other factors that may also affect the formulation process and choice selection are indicated in the following tables.

TABLE 3.1-1 SERVICE TO USERS

Code	Service
A.1	On-line search of published documents and reports
A.2	Referral to other databases and services
A.3	Provision of resource and talent information
A.4	Provision of periodic bulletins/newsletter
A.5	Provision of electronic mail
A.6	Provision of hardcopy/microfiche/magnetic tapes
A.7	Research of fugitive files and all databases to prepare a report on a specific subject of interest to a user of the STIS

The optional services (listed in Table 3.1-1) that may be packaged by the STIS in some combination, range from providing limited interactive informational support to providing research assistance on specific subjects. Output products vary from providing computer printouts (or even handwritten notes) in resource or report citations to disseminating materials such as copies of reports, newsletters, or bulletins. The impact of these services on size, staff, and cost, are considered in the discussion of the optional STIS configurations (Section 5.0 of this report).

TABLE 3.1-2 EMERGENCY MANAGEMENT INFORMATION COORDINATION

Code	Service
B.1	Organize national guidelines for emergency management information methodology and exchange
B.2	Organize a universal lexicography for an emergency management reference system
B.3	Organize an emergency management information network with public sector and university facilities nodes
B.4	Organize an electronic mail network
B.5	Set up, train, and provide support for regional satellites of an STIS
B.6	Organize a process of informational exchange between Federal agencies and technical information centers

Table 3.1-2 suggests FEMA coordination activities that would improve the distribution and use of scientific and technological information. It should be a component of the STIS. The sophistication necessary to implement some of the coordination activities of the table would require the full time of a staff member.

Table 3.1-3 suggests that the STIS services can be provided to a limited group of users or opened to all interested in emergency issues. The issues of "need to know" and security of the information will be considered in configuring the STIS options but are not dominant considerations. While the range of the subject matter may cover scientific and technological subjects relevant to national security emergencies as well as domestic emergencies, the STIS is assumed to be a distributor of information, not an archive of classified documents.

TABLE 3.1-3 CLASS OF USERS

Code	Class of User
C.1	FEMA Personnel
C.2	Other Federal agencies' emergency management planners
C.3	Other Federal agencies' professional staff
C.4	State and local government emergency management planners and practitioners
C.5	Other State and local government officials
C.6	Researchers
C.7	Graduate students
C.8	The general public

The delineation of internal management (Table 3.1-4) is given to detail the activities that would be required if differing STIS options are chosen.

TABLE 3.1-4 INTERNAL MANAGEMENT

Code	Activities
D.1	Collect talent bank information and maintain the file
D.2	Organize and keep an information exchange between other public sector agencies active
D.3	Collect materials (abstracts, reports, books)
D.4	Develop criteria for (a) entry to databases, (b) storage in fugitive files, (c) material elimination, etc.
D.5	Set up information retrieval system
D.6	Set up library of (a) hardcopies, (b) vertical file, (c) microfiche, etc.
D.7	Catalog, index, and abstract D.4 materials
D.8	Process and edit D.7 materials
D.9	Set up and maintain material dissemination process
D.10	Organize and operate a self-evaluative system to dynamically improve the STIS

3.2 STIS OPTIONS (Element E of Figure 3.0-1)

The needs assessment, surveys of material resources, evaluation of the talent bank configuration, and perceived services and desired products describe the information system requirements. The level of incorporation of these requirements determines the parameters of the proposed STIS design. Figure 3.2-1 diagrams a design selection methodology that presents the difference between the potential system options. The selection methodology is pictured as a logic tree which branches on decisions based on (a) the method of service delivery and (b) the level and type of service and products.

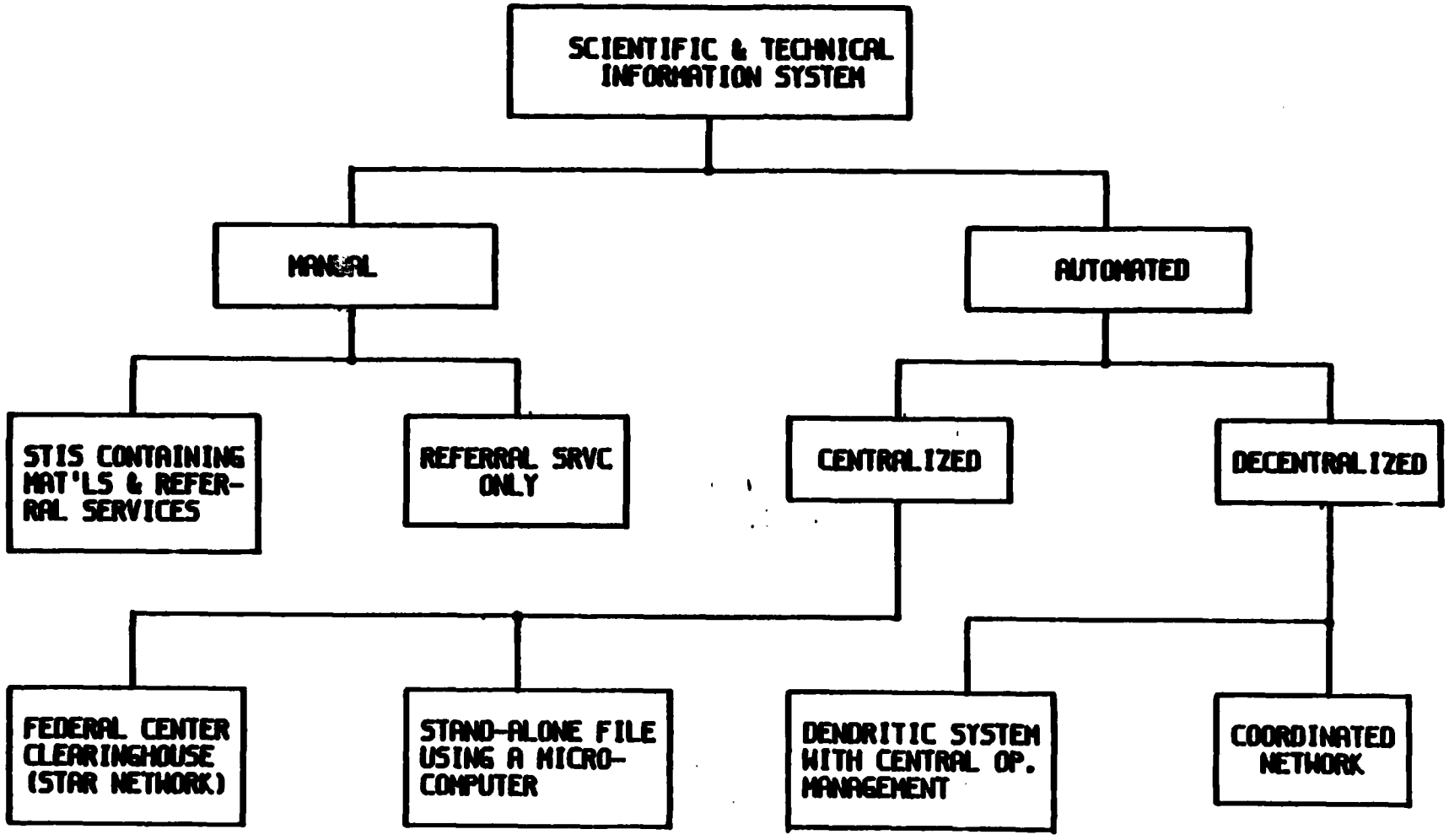

FIGURE 3.2-1 SCIENTIFIC AND TECHNICAL INFORMATION SYSTEM SELECTION TREE

The general premise of this study is that there is no preconceived "desired" STIS configuration. The assumption is made that the findings of the study and the trade-off of cost/service system relationships will suggest the best choice among the options (or a variation of the options or a hybrid of some of the options). Economics and FEMA budgets, however, may not permit the best option to be exercised. The study recommends (Appendix A) the use of a cost/service relationship test that may suggest the optimal compromise between system and cost.

The logic of the design selection methodology poses the first decision element - should the STIS be manual or automated? If manual, then two optional configurations may be assumed:

> Configuration 1 - The STIS would serve only as a reference and referral service maintaining card catalog files on (a) sources and types of emergency related materials available in existing libraries and (b) sections of supporting agencies and consulting talent who have specialized knowledge in emergency related areas. The STIS would respond primarily to FEMA, other Federal agencies, and state and local emergency management personnel.
>
> Configuration 2 - The STIS would maintain the card catalog file of Configuration 1 and, in addition, would also maintain vertical files containing (a) reports listed in the card catalog, (b) resumes of the personnel listed in the talent bank card catalog, (c) descriptions of FEMA and other Federal agencies' emergency related plans and programs, and (d) descriptions of state and local government programs, etc. The library service would be limited to public sector personnel.

If the decision is to automate the STIS, Figure 3.2-1 suggests that a second decision must be made. Is the automated system to be centralized or decentralized? If centralized, two optional configurations may be assumed:

> Configuration 3 (A stand-alone system) - The STIS would contain the same information as described in the manual catalog file of Configuration 1. The files, however, would

be maintained on a stand-alone microcomputer. The computer, with an added modem, would also be utilized as a terminal to retrive commercial database information (DIALOG, ORBIT, BRS, etc.). Because of its small size, the system is intended to respond primarily to the queries of public sector personnel.

Configuration 4 (Star Network) - A FEMA STIS would be the central repository of all emergency related reports and materials. It would be responsible for collecting all relevant domestic and national security related information and material from all known sources and electronically cataloging (on a minicomputer or mainframe computer) the content of this information. Acting as the central clearinghouse of emergency information (reports and talent bank), the STIS would directly retrieve and disseminate desired information to all authorized users. It would provide on-line interaction to users and hard copy reports, if desired.

Again, if the automated system is decentralized, two optional configurations may be assumed:

Configuration 5 (Dendrite Network) - As in Configuration 4, the STIS would be responsible for collecting and organizing the emergency related information database in a nationally centralized system. The difference, however, is that the computerized database developed in Configuration 5 would be provided to regional centers and to other Federal agencies either as magnetic disks or through electronic networks. It would be the responsibility of the branching network to provide on-line search and referral services to the user; the central STIS would provide desired hard copy materials and support research using the central fugitive files.

Configuration 6 (Coordinated Network) - FEMA would chair a coordinating process to standardize the information gathering, information processing, quality control, user interface methodology, etc. used by all information centers in a consortium. Each member of the consortium would specialize in one technical area. Their responsibility would be to collect and electronically process scientific and technical information in their chosen field. The processed information of each information center (a node in the network) would be available to all the nodes in the system. FEMA would also serve as a node in the system and would also collect and process information in only one technical area. Each node would service the users that contact that facility.

There are obvious variations and combinations to these configurations. In the main, however, the principles required to design the basic systems suggested by Configurations 1-6 would consider potential variations. It will be the purpose of Section 5.0 of this report to detail these configurations and variations.

4.0 FINDINGS ON NEEDS AND AVAILABLE RESOURCES

This section details the findings of the study that serve as primary factors in determining STIS requirements. The details will include:

- A report on the findings of the needs assessment study. A tabular compilation of the organizations visited is presented (See Appendix B) and a summary of perceptions of STIS needs is given.
- A report on the findings of available information resources. (See Appendix B). The report enumerates a number of information centers that collect, process, and disseminate information on materials by classes of domestic or national security technical interest. The report includes a tabulation of a sample of these resources.
- A discussion on the conceptualization of a talent bank and its organization requirements. A report on the findings of a survey to determine the size of the talent bank is given.

4.1 NEEDS ASSESSMENT FINDINGS

This section describes the findings of the needs assessment study completed between October 1983 and January 1984. Project staff interviewed 43 potential STIS users or professionals who managed information centers and libraries. The professionals and organizations interviewed during the needs assessment study can be categorized as follows:

1. FEMA Directorates/Regional Offices
2. Specialized Libraries
3. Other STIS Users and Resources

Each category is discussed in detail in Appendix B of this report. A brief summary of the major findings of the needs assessment is described below.

FEMA Directorates and Regional Offices

Interviews were held in four of the five FEMA Directorates and in two of the ten regions.

- The Information Resources Management Office detailed a three phased program to improve FEMA's hardware environments and cited several specific ADP needs that an STIS could provide (e.g. micro-economic information).

- The National Preparedness Programs Directorate underscored FEMA's coordinating role with such other Departments as Energy, Defense, Agriculture, and the Treasury. The directorate personnel specified a need for keeping informed on important research completed by or for FEMA as well as applicable research in other agencies.

- The Training and Education Directorate cited a need to access a variety of experts in different disciplines for instructional purposes and also indicated a need for a emergency management clearinghouse for local officials.

- The State and Local Programs and Support Directorate indicated a similar need, especially in reference to hazard identification and analysis and the capability assessment portions of the Integrated Emergency Management System (IEMS).

- Personnel at the FEMA regional offices also voiced their frustration about the inability to adequately supply local emergency program managers with all the necessary information for them to implement IEMS.

Specialized Libraries

Four specialized libraries relevant to the roles and missions of FEMA were visited.

- The National Bureau of Standards (NBS) and the Center for Fire Research. NBS has a standard reference program that generates high quality data on physical phenomena. The information system library at the Center for Fire Research has holdings of about 30,000 items, consisting mostly of technical reports on fire protection and research. Personnel at NBS suggested a closer link with the Federal Laboratory Consortium. The Consortium could be very valuable in the development of a FEMA "talent bank" by serving as the inner circle or starting point in the identification of technically qualified experts in various areas.

- Disaster Research Center, Ohio State University. The Center has a collection of approximately 12,000 items on disaster phenomena from a social behavioral perspective. The staff at the Center felt that a general strengthening of the profession of emergency management is occurring. They also opined that there is an important need to create an information system to serve these researchers and users.

- Center for Technology, Environment, and Development (CENTED), Clark University. Since 1973, CENTED has systematically tracked and collected materials on roughly 100 technological hazards. CENTED has extensive organizational relationships nationally and internationally with other risk management programs. The center has been discussing the feasibility of linking its information dissemination efforts with the Natural Hazards Research and Applications Information Center at the University of Colorado.

- Natural Hazards Research and Applications Information Center, University of Colorado. The center serves as a national clearinghouse for information on natural and technological hazards research and management. A serious concern expressed by the staff at the center is the issue of compatability with other automated library systems. The center is seriously considering automating its collection this coming year. They are hoping FEMA will take a leadership role in coordinating this effort.

Other STIS Users and Resources

- The University Center for Urban and Social Research, University of Pittsburgh. The Center has been developing a qualitative data base on research results dealing with public attitudes and behavior in crisis and non-crisis conditions. A large number of documents were found to be fugitive by the Pittsburgh research team. Clearly a large amount of valuable research is being lost.

- Dr. Thomas Drabek, Professor of Sociology, University of Denver. Dr. Drabek has identified and abstracted the sociological literature on disaster research. Drabek has concentrated his effort on the literature produced after 1972 and has abstracted nearly 900 items. Researchers have a great deal of difficulty in physically obtaining documents. Practitioners, who also need to access emergency management documents to support their policy formulation, would have a much greater difficulty in finding the appropriate research.

4.2 SURVEY FINDINGS

The availability of materials in areas related to emergency management is discussed according to three different categories: (a) FEMA libraries, (b) reports available using a commercial information system (DIALOG) to interrogate the NTIS database, and (c) resources available from special libraries throughout the country.

FEMA's Learning Resource Center, housed in Emmitsburg at the National Emergency Training Center has a staff of 11 (full-time equivalent employees) and has extensive holdings focussing on emergency management, emergency preparedness and training, and fire science. The Information Resource Management Library, located in Washington, D.C., contains far fewer holdings (2,000 volumes compared with 40,000 volumes) and is staffed by two people.

An additional measurement of the magnitude of the existing resources upon which emergency management officials, FEMA, and the general public can draw is to look at the number and types of reports currently available. Table 4.2-1 shows the number of documents available from NTIS through one database search using key words pertaining to emergency management. The search, which used the key words shown in Table 4.2-1, identified over 25,000 pertinent reports.

To show the vast resources that are available in public and private libraries across the country, a second exercise was undertaken to identify some of the numerous special libraries with holdings related to emergency management. Using the Directory of Special Libraries and Information Centers, (6th Edition) over 500 such libraries and information centers were identified in 29 generic topic areas. To facilitate the research, those generic topics which either touch upon or encompass emergency management were selected. As a result, some topics are very broad in scope (e.g., chemical engineering) while others are more directly targeted to emergency management (e.g., emergency preparedness). As one might imagine, the largest number of special libraries are for those topics covering broad areas--85 libraries were listed for pollution, 79 for chemical engineering, 76 for public health, and 60 for communication. At the other end of the continuum, only five libraries were listed for earthquakes, three for disasters, two for national security, and one each for civil defense and hurricanes.

Table 4.2-2 that can be found in Appendix B of this report presents the findings of the survey in summary form showing the total number of

TABLE 4.2-1 EXAMPLES OF REPORTS IN THE NTIS DATABASE THAT ARE GERMANE TO FEMA

SUBJECT	NUMBER OF REPORTS
Agricultural Assistance	251
Crisis Relocation	128
Disaster Loans	16
Earthquake	3,239
Emergency Assistance	407
Emergency Communication	534
Emergency Housing	210
Emergency Response	761
Epidemiology Emergency	38
Evacuation	818
Fire Prevention	1,108
Flood	5,496
Highwater	4
Industrial Mobilization	189
Industrial Protection	10,135
Landslide or Mudslide	85
National Security Emergency	43
Pollution Emergency	526
Population Protection	848
Radiological Incident	56
Rescue Operation	125
Temporary Housing	83
Tidal Wave	264
Volcanic Eruption	102

special libraries and information centers listed under each category, followed by between one and three samples of libraries with holdings in that category. A total of 53 libraries are listed. The information in the table is as follows: name and location of library, subjects of interest, assets, automated system (if so indicated) and number of staff. These examples provide yet another idea of the magnitude of available resources in emergency management.

4.3 DESIGN AND ORGANIZATION OF A TALENT BANK

A resource file (entitled the talent bank) which contains a listing of organizations and professionals with expertise in domestic and national security emergency areas will be a component of each of the STIS configurations considered in Section 3.2 of this report. The design and organization of the elements of the talent bank will be discussed in this section to (a) highlight the universal characteristics of this file in all the STIS configurations and (b) report on the findings of a survey to approximate the size of this file.

The elements of design of the talent bank resource include the following considerations:

- Contents - Emergency management and scientific and technological expertise required in planning for emergency situations (or solving an emergency problem) encompass such a broad spectrum of knowledge that to be responsive to a majority of queries for information, the talent bank must contain the names of organizational sources as well as names of public and private sector technologists. The talent bank may include (1) a listing of divisions of public sector agencies that may be responsive to all categories of emergency topics, (2) private sector organizations

that have built up expertise in a specialized area of interest and (3) identity of known government professionals, academicians, and private sector consultants who are engaged in the complex categories of emergency issues.

- Size - The size of the databank is predicated on (a) the number of sub-specialty categories and (b) by the definition of "level of expertise." It is anticipated that the talent bank will grow dynamically as additional sub-specialties are found. It will probably be necessary to appoint a selection board to define "expertise" and pass on the qualifications of each candidate. The number of identified agencies and experts that can be included in the talent bank will affect the system design because it will dictate the methods of collection, storage, and retrieval. It will affect the size of staff required to manage an updated system and also provide proper service to the talent bank client. It will also affect the hardware and software used in the event that the system is automated.

- Organization and Use - The external appearance and/or the final product of the talent bank may be configured in several ways. It may take the form of a published compendium of recognized experts in the major categories of emergency management and allied technical fields. Such a document could be distributed to known potential users. It may take the form of a computerized on-line information base available at processing centers to emergency management practitioners who call for assistance in identifying known experts in a given area.

- Information Collection Method - Two extreme courses and a spectrum of combinations of the two courses are possible. Course A, the least expensive method, would be to send out questionnaires to agencies and organizations known to have specialized expertise and hope for significant responses. Course B, the proactive method, would utilize a professional level staff person to directly solicit information by personal contacts and formal arrangements with public sector agencies, universities, professional societies, private sector institutions, companies, and consultants. The design would have to consider the most cost/beneficial relationship of courses A and B or variations combining both.

- Processing, Retrieving, and Responding to Data Users - The design choices are to use a manual system or an automated system.

Figure 4.3-1 illustrates the interrelationships of these factors in the organization and operation of a talent bank. The flow diagram of the Figure suggests that the system design be based on a plan (Element 5 of Figure 4.3-1) which defines the content and method of managing the talent bank database. The plan would have a generic relationship to the final product, whether it be a documented compendium of emergency issue specialists, a computerized database intended for on-line retrieval, or both. The focus of the plan would be to:

- Define the content of the talent bank in great detail. The plan would structure the degree of sub-specialization in each area of technical expertise. The potential degree of sub-specialization is beyond the grasp of one person to define. The task of the planner would be to organize a good "first list" of types of sub-specialization by talking to FEMA and other Federal agencies' technical specialists. This list would be structured so that it would accommodate dynamic expansion of the types of sub-specialization.

- Define the database coding and referencing methodology. The plan will have to consider the methods to code and reference the sub-specialities and unique talents of the public sector agencies, private sector institutions and companies, government employees, private sector consultants, experts, scientists, etc. listed in the talent bank. The plan would consider the coding and reference system in terms of efficiency and time-optimization of the retrieval of data. While a manual system for the coding and referencing may be considered, a computerized system is more realistic in this era of the small stand-alone machine.

- Define the format of the data that would be contained in each personnel record in the talent bank and provided to the user of the system (in hard copy or on-

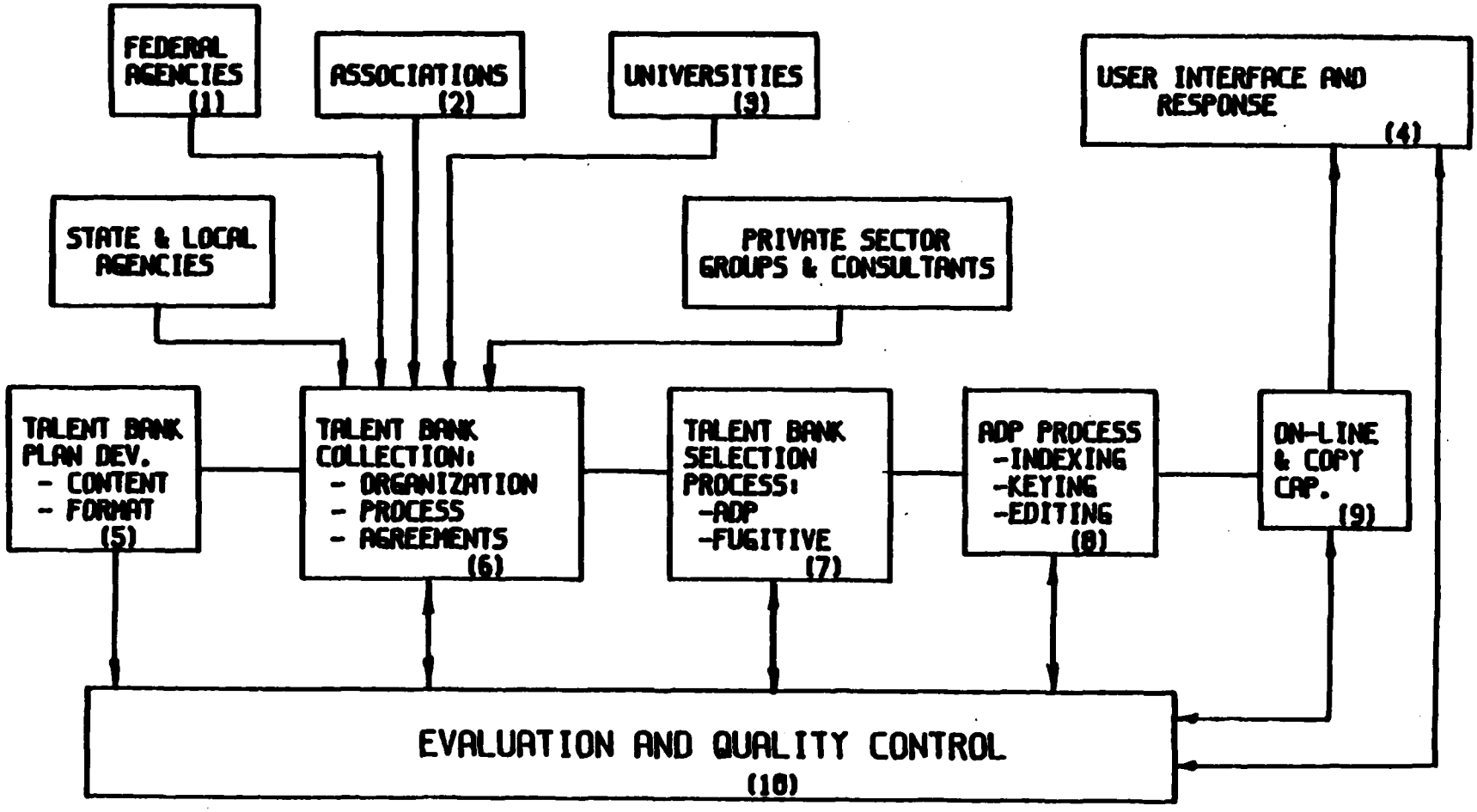

FIGURE 4.3-1 ORGANIZATION AND OPERATION OF THE TALENT BANK

line terminal display). The format may contain informational elements such as:

- Name and assigned reference number
- Primary and secondary affiliations
- Address (business and home)
- Telephone (primary and alternate)
- Expertise code(s) which includes primary and secondary areas of talent
- Education code(s) (degrees, schools, etc.)
- Availability code (public or private sector, method of support, ability to travel, etc.)
- Military, police, paramilitary, emergency management experience
- Abstract of experience (VITA)

The planning phase would also suggest the criteria for the collection of talent bank information. Figure 4.3-1 illustrates this activity as Element 6. The criteria developed in the organization of the collection process may include the following precepts:

- o The collection process is to be independent of the method of product delivery. The data within the talent bank would be as useful in a compendium as in a computerized on-line system.
- o Current data are to be maintained by a process of continuing review and communication with public sector agencies and private sector institutions and companies.
- o Where possible, formal information sharing agreements are to be developed with agencies and institutions to maintain optimal responses from the potential contributers to the system.

- o The talent bank control personnel will develop a uniform information collection instrument which will be designed to facilitate data entry into an automated system.

Figure 4.3-1 suggests that the primary sources of information input to the talent bank collection process (Element 6) are the Federal agencies (Element 1), the professional associations (Element 2), and the nation's universities (Element 3). These facilities have files and directories of their personnel. These materials, as well as direct referrals from the agencies and institutions, provide the baseline of the talent bank.

Element 7 (entitled Talent Bank Selection Process) of Figure 4.3-1 indicates the task of sorting the collected data in order to construct a selective database. The term "selective" is used to denote the inclusion of expert talent that can also be responsive to outside queries (the talent bank is not assumed to be a compilation of all technical workers in the domestic and national security emergency fields). This is to say that not all collected personnel resumes will be included in the talent bank. Those resumes that are not added to the talent bank will be retained in a fugitive file.

To obtain the selective database, criteria for sorting will have to be developed. Unfortunately, the qualification term suggested as "expert" is subjective. In attempting to estimate the size of the anticipated population of experts in the talent bank, FEMA personnel and personnel from other Federal agencies who specialize in emergency related areas (flood, earthquake, population protection, etc.) were asked for their opinions on the population of experts in their field. Some respondents were liberal in their assessment;

others were extremely conservative. Opinions ranged from concepts that the size of the talent bank:

- Would be small (under 1,000 records) according to the most critical respondents whose judgement assumed (a) the highest level of expertise and (b) the availability of those identified in the talent bank to support those querying the STIS.
- Would contain 3,000 to 5,000 records assuming a less critical definition of expertise.
- Would contain more than 10,000 records if a liberal interpretation of technical area expertise is used and a high degree of sub-specialization is included.

Table 4.3-1 summarizes the results of the survey which asked a sample of specialists for their opinions on the numbers of experts in their area that should be included in the talent bank. The Table shows that the file would probably consist of very many specialty classifications with a small number of identified experts and a few categories which have very large numbers of identified specialists (fire prevention, nuclear engineering, etc.) who have been trained to cope with emergency situations. Whether all in the latter group of specialists should be included in the talent bank is problematic. Many of these technicians may not be available or capable of giving support to the STIS users. As a precedent, a report developed for the National Emergency Training Center of the Emergency Management Institute of FEMA, lists only 197 organizations in its resource file as capable and available of providing technical assistance and training in issues involving public policy development.[1]

[1] Formulating Public Policy in Emergency Management - A Course Book and Resource Manual for Public Officials (IMR Corporation, Winter 1983).

To resolve the fine points in the definitions of terms such as talent and expert, the selection criteria should be approved by a FEMA governing board.

The potential size of the database and the availability of software suggests that the talent bank should be automated in order to either (a) provide on-line interactive service or (b) simplify the preparation of a talent bank compendium. For both cases, a process of (1) annotation, (2) appendix organization, (3) keying of the record content into a computer file, and (4) editing of the context of the file is required. This group of mechanical tasks is indicated in Element 8 of Figure 4.3-1.

The product of the computer processed database of Element 8 can be utilized to (a) supply other libraries with a magnetic record of the talent bank file, (b) make a camera-ready copy for publication of a compendium, or (c) support an on-line interactive search system. This is indicated in Element 9 of Figure 4.3-1. Options (a) and (b) can be accomplished off-line or by a remote job entry process with the FEMA mainframe computer. Option (c) can be accomplished with a stand-alone table top computer or with a terminal networked to the FEMA mainframe computer. The selection of the most efficient table-top computer to support the on-line interactive mode is dependent on the size of the file and the level of usage. Assuming approximately 1,000 bytes per individual record, and a file of 3,000 to 15,000 records, then the compuer storage must accomodate 3 to 15 megabytes.

TABLE 4.3-1 SURVEY RESPONSES ON SIZE OF TYPICAL TALENT BANK COMPONENTS

Emergency Related Areas	Approximate No. Area Experts
Behavior and Social Concerns	25
Civil Defense	200
Civil Preparedness	20
Communications	500
Crisis Relocation	15
Disaster Loans	100
Earthquakes	500
EMP	250
Emergency Management	100
Evacuation	150
Fallout Shelter Design	300
Fallout Radiation	2000
Fire Prevention	5000*
Government Operations	150
Industrial Protection	75
Hazards Analysis	1000
Hazardous Material Cleanup	150
Hazardous Material Transportation	100
Health Resources	250
Mass Housing	20
Nuclear Engineering	3000*
Radiation Control	2000
Radiological Instruments	30
Reception Care and Lodging	20
Temporary Housing	50
Terrorism	100
Transportation	50

* First and Second Level of Expertise

While retrieval of the file can be managed with a small business microcomputer (IBM PC, Apple II, TRS-80 Model 12, etc.) and multiple floppy diskettes (manually sorted), the more efficient method of implementing the on-line interactive system would be to utilize a computer with a hard disk drive. If the talent bank file is comprised of the smaller file estimate of 1,000 to 5,000 records, a microcomputer that contains a hard disk (IBM XT, TRS-80 Model 16, etc.) or can possibly be modified to support a hard disk unit should be used. If the talent bank file size approaches the larger file estimate (10,000 records or more) then a minicomputer such as a VAX 11/750 should be used. Both size computers are being used within FEMA. The larger computers have the added advantage that they can be adapted to handle multiple, and simultaneous, queries if the on-line response system requires more than one terminal.

The establishment of an on-line interface with potential users of the talent bank implies the organization of a system which permits users to (a) visit the facility, or (b) communicate by telephone to obtain access to the talent bank file (Element 4 of Figure 4.3-1). The extent of this client interface will probably be determined by how much it is encouraged. If (a) it is a free service, available to all Federal, state, and local government agencies as well as researchers and (b) it is found to be productive, then the talent bank will have wide usage and may require a full time cadre to maintain it. The level of its use will therefore probably be tailored by the FEMA objectives in providing the service and by available funds to maintain the required support staff.

As indicated in Figure 4.3-1, an evaluation and quality control component (Element 10) should be incorporated in the system to overview the effectiveness of plans, processes, and techniques used in the information system, and to update and purge the talent bank file on a regular basis. The evaluative and quality control process should be on-going and interactive with the personnel performing the tasks of the system. The effectiveness of these tasks should periodically be reported in formal status reports of deficiencies and recommendations for improvements to the processes and contents should be considered in scheduled review sessions.

DESIGN OF A

SCIENTIFIC INFORMATION COLLATION AND DISSEMINATION SYSTEM

SECTION II

SYSTEM DESIGN CONCEPTS

5.0 SYSTEM DESIGN CONCEPTS

The design concepts of a Scientific and Technological Information System (STIS) is formulated by identified needs, by existing resources, by structured FEMA objectives, and by FEMA's ability to fund an STIS. The identified needs and potential sources of cooperative information interchange have been described in the needs assessment findings (Section 4.1), the survey of existing information centers (Section 4.2), and the concept and sizing of a talent bank (Section 4.3).

The structured objectives that form the guidelines for the system design concepts are paraphrased as follows:

- Provide details of the parameters of the optional designs of the FEMA STIS. The primary purposes of such designs are to organize a facility that can coordinate and manage FEMA informational assets (Objective 1).

- Develop a plan to ensure access and interchange among FEMA controlled and FEMA supported informational elements (Objective 2). The criteria for success in achieving a workable plan will be in the ability to (a) obtain use of complementary, rather than redundant, informational assets and (b) develop standardized methods for collecting, processing, and retrieving the individual information bases so that there is efficiency in the informational interchange.

- Develop a plan to include informational assets which exist outside of FEMA into the planned STIS (Objective 3). The criteria for success in achieving this objective will be similar to those of Objective 2.

- Detail methods to implement a rapid response interactive system to provide FEMA staff and other potential users with hazards and emergency-related scientific and technical information (Objective 4). The criteria for success in achieving this objective will be measured by (a) the degree of informational detail that can be obtained by the rapid response interactive system, (b) the degree of use that the response system makes of external information resources, (c) the number of users that can be accommodated at the same time by the planned

STIS, and (d) the extent of the other classes of users (other Federal agencies' personnel, state and local government administrators and practitioners, public sector consultants, etc.) that are serviced by the system.

It will be the purpose of this section of the report to suggest STIS options that meet these objectives in different degrees. As each option is described in this section it will be tested against the criteria set by objectives 2 - 4 above. Without consideration for budget constraints the most sophisticated system would probably be the most responsive to all criteria. With budget constraints, such a system may not be realistic. Therefore, as part of this study, consideration of the cost/service trade-off will be given for each option discussed.

5.1 SCIENTIFIC AND TECHNOLOGICAL INFORMATION SYSTEM (STIS) OPTIONS

Within the dynamics of technological realities and FEMA's budget, there is a spectrum of configurational options for a FEMA STIS. The basic features of six options were summarized in Section 3.2. Their familial relationship was illustrated in the STIS selection tree of Figure 3.2-1. This section of the report will consider the activities, output products, structure, internal processes, potential start-up costs, and continuing annual budget of each of these six STIS options.

The objectives of the options are similar. They all propose to serve, to some degree, as an information linkage mechanism that informs practitioners, administrators, and researchers about programs, resources, practices, and findings in hazards and emergency related areas. The differences in the options are in how they are (a) philosophically structured to meet these objectives and (b) physically structured to support the philosophical

concept. The first attribute considers whether the STIS is to be centralized or decentralized. It also considers the level of coordination to be provided by FEMA to integrate a national information system in emergency related fields. The second attribute considers the equipment and staff required to implement the STIS.

The attributes of the options determine whether the STIS is to be an information center or a clearinghouse. The difference between the two structures is in (a) the level of subject material collection, (b) the extent of information processing, retrieval, and dissemination, (c) the amount of client support that is provided, and (d) the central position of the facility as an information source. In its simplest form, an information center acts simply as a facilitator to support a user in obtaining information. As such, it usually contains a generalized database of information about programs, subject experts, and sources of published material. The existing, or available, database may not even have been developed at the information center. The database is primarily used as a reference and referral guide to materials and resources located at other facilities.

A clearinghouse, on the other hand, has a greater base of activities, a higher level of response to clients, and is recognized as a primary information source on a topical subject. Distinctive features are that:

- The clearinghouse is focused on a specific subject area and targeted audience. Information is not collected on all topics.
- The clearinghouse engages in the acquisition of literature-based information related to its focused area as well as maintains a database representing records of the literature-based resources. (The term "literature" is

defined to include non-published materials, audio-visual materials, descriptions of organizations and talent resources, etc.) The STIS clearinghouse would thus contain (a) an in-house computerized database on emergency related subjects that would complement existing commercial and other Federal agencies' computerized databases, (b) fugitive files on unpublished reports and articles, (c) shelved materials, and (d) talent bank information.

- The clearinghouse processes the acquired information into a collection with an index and other tools to permit systematic search and access. (These tools do not have to be in a computer-readable form.)

- The clearinghouse solicits inquiries and establishes minimal requirements in the form of the inquiry. It is willing and able to accept inquiries made in person, by phone, or by letter. It responds to inquiries in a nonstandard fashion, if necessary.

- The clearinghouse must be willing and able to conduct systematic searches of its information collection beyond that available in the published literature collection. Thus as a process facilitator, the clearinghouse supports a topic research by providing an analytical component to go with the search component as a means of integrating the findings of published and unpublished reports and articles on a specific subject.

As there are differences, there are also similarities in the logic of organizing and delivering information services of seemingly diverse STIS options. This is true whether they are structured as information centers or clearinghouses. All the STIS options must organize some procedures for efficiently interfacing with their clients. They may also utilize similar logic and concepts of material collection. Similarities may extend to methods of information cataloging and indexing, and levels of interactive support. The point that is being made is that the differences in the options tends to be in (a) the degree of service that FEMA wishes to provide in a central facility at FEMA and (b) the level of informational support obtainable from an STIS.

There is also continuity in methodology when modifying an option to provide additional services. In fact, modular additions to one option or improvement in mechanization by the addition of a technical tool (i.e., a computer) alters one option so that it describes another.

As a procedural matter, the STIS options of this report will be described sequentially from those providing the least to those providing the most service. In that way, the common methods (where they exist) of material collection, information cataloging and processing, and information retrieval and dissemination can be described without redundancy. The apparent similarities between the options can thus be demonstrated.

The similarity in the baseline process of the STIS options itself suggests a further option. FEMA could build up an STIS capability in a modular fashion improving its process and/or delivery service at a more judicious pace. It could thus test the utility of each provided service.

There is a caveat to the argument for building the STIS in a modular fashion, however. It negates the concept of organizing standards for a unified, integrated network of information centers. Thus, it is self-defeating if it is the intent of FEMA to coordinate a national STIS network. As indicated in section 4.1 (Needs Assessment Findings), other information centers are developing their own databases, their own concept of service, and their own internal processes. The danger is that if the FEMA sights are restricted to constructing an internal STIS one module at a time, then external information systems which should complement each other will be

built without consideration for common standards and practices or usage. Thus FEMA controlled and/or FEMA supported information elements and information centers outside of FEMA may not be capable of being used to network efficiently.

Thus, while the objectives of the options are similiar and the technology exists for the most sophisticated STIS configuration, the choice may be primarily one of budget. And the most significant cost factor is not in computer implementation. Mainframe, minicomputer, or microcomputer facilities exist within FEMA to augment any of the STIS options. Software programs can be developed at a reasonable cost and commercially packaged software can be used to implement an efficient database file system. The highest cost factor is the expense of staffing a facility with the expertise to organize and maintain the database and service the users of the system. Because cost is a limitation of any system, this report will estimate the composition of the staff for each option, and the inherent start-up and annual budget of the option.

5.1.1 Manually Operated STIS - Referral Service Only

Figure 5.1.1-1 depicts the components of the simplest STIS configuration. It is an information center whose holdings are primarily cross-referenced data of (a) facilities where scientific and technically detailed information on hazards and emergency related subjects can be obtained, (b) programs within the divisions of the Federal and state agencies that have scientific or technical content in hazards and emergency related areas, and (c) talent bank information identifying specialized area experts.

Figure 5.1.1-1 (and subsequent diagrams of the other STIS options) is coded to illustrate the significant features of the system. The codes refer to items of Table 3.1-1 (Service to Users), Table 3.1-2 (Emergency Management Information Coordination), Table 3.1-3 (Class of Users), and Table 3.1-4 (Internal Activities).

Thus in Figure 5.1.1-1, codes A2 and A3 describe the anticipated service to the STIS users (codes C1 - C4, C6). Codes D1 and D2 describe the internal activities necessary to provide the anticipated service:

- A2 - Referral to other databases and services
- A3 - Provision of resource and talent information
- C1 - FEMA personnel
- C2 - Other Federal agencies' emergency management planners
- C3 - Other Federal agencies' professional staffs
- C4 - State and local government emergency management planners and practitioners
- C6 - Researchers who are involved in the programs of the C1 - C4 categories
- D1 - Collect talent bank data and database content information of commercial services, Federal libraries, Federal agencies, and academic sources
- D2 - Organize and maintain an active information exchange between other public sector agencies

The code elements appear trivial and the services and tasks appear to have a major clerical content and a routine procedure. If, however, this STIS model is to have any credence in the scientific and technical community which it hopes to serve, then the staff will have to be very professional and highly respected.

The person responsible for the STIS would have to have a broad outlook and a gregarious nature. This person cannot be merely an administrator or a librarian or the keeper of a file cabinet of random information. He/she

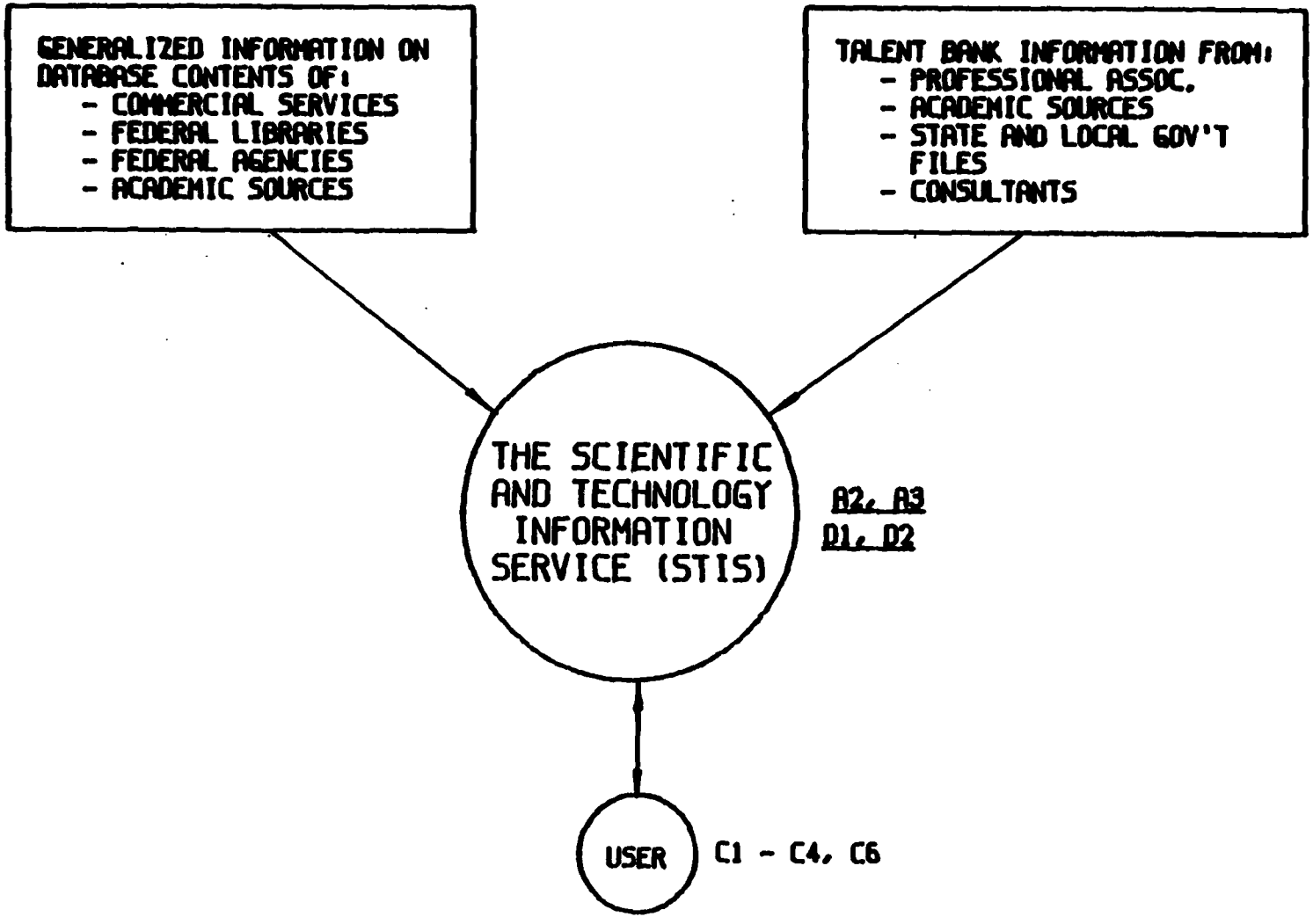

FIGURE 5.1.1-1 REFERRAL SERVICE - MANUALLY OPERATED

will have to be (a) an organizer, (b) a motivator who can "sell" the concept of an active information exhange between agencies and (c) a scientist or technologist who can transcend his/her area of specialty in order to anticipate the needs of other researchers and technologists and understand the methods of research that would be supportive of the scientific and technical community involved in hazards and emergency related programs. To have credence outside of FEMA, the custodian of the STIS should have a working knowledge of the major FEMA programs and especially those that are research and development related so that he/she can react knowledgeably to external queries. To have credence inside of FEMA, the custodian of the STIS would have to demonstrate knowledge of the sources of information throughout the bureaucratic spectrum and the location and names of subject experts.

The reason that the person responsible for the STIS has to be such an important figure is that he/she will represent FEMA to the outside community involved in scientific and technological information exchange. It is a sophisticated community and that person must be recognized as the focal point of scientific and technological information sharing within FEMA. If this STIS model is large and the internal products are very significant, recognition of its importance would come naturally. But on the surface, as postulated by this model, the STIS is not a significant element of FEMA. The character of the custodian of the STIS will thus have to compensate for the minimal size of the operation.

5.1.1.1 STIS Tasks

The person responsible for the STIS and his/her co-workers will have to be a productive staff devoting full time to the STIS operation. As shown in Figure 5.1.1-1 (and the codes indicated in the pictorial), their main functions will be to collect and maintain talent bank data and generalized information about products and programs available at other public and private sector agencies and information centers. Both databases will be maintained as card catalog files. While similarities exist in the tasks of developing, maintaining and using the databases, they are enumerated separately to illustrate the nuances of the staff's tasks in organizing and managing both files. Thus, the key tasks in developing and maintaining the talent bank will be in:

- Defining the sub-categories of talent bank specialization and incorporating new sub-categories as they are identified.
- Developing an on-going procedure for activating and information exchange with professional agencies, academic sources, federal, state and local government agencies, and private sector consultants to obtain the names and detailed information on the experts that are to be included in the talent bank.
- Formatting and maintaining the records of the talent bank so that the contents include the most pertinent data of the expert; as a corollary, the records are to be periodically up-dated to (a) include the most recent experience of the talent bank experts and (b) purge the names of those in the talent bank that, for some reason, did not meet pre-established criteria.
- Developing, and keeping current, an indexing system to permit location of the best matched expert(s) to a specified request by subject, location and affiliation, availability, terms for consulting support, etc. In developing the indexing system, thought will be given to the best methods of converting the talent bank information into an automated file.

- o Providing support to clients wishing to use or peruse the talent bank whether by correspondence, telephone contact, or personal visit.

- o Developing a format for providing the information to the requester. While this STIS model would not publish a talent bank resource guide, a formated method of communicating the response to the information request is in order to expedite and formalize the response.

- o Developing a reporting system so that a record of requests, subjects requested, effectiveness of STIS response, and effectiveness of the identified responding talent(s) is recorded and available for analysis. The determination of effectiveness of the identified talent will have to be obtained by client feedback approximately two weeks (to one month) after the information is provided. The STIS will take the initiative to obtain this information feedback.

- o Developing a method for periodically evaluating the results of the talent bank service so that it can be improved.

The FEMA staff responsible for developing, collecting, and maintaining the talent bank will perform similiar functions in developing a bank of referral sources. This second resources file will document information on information centers, libraries, clearinghouses, etc. that provide specialized scientific and technical knowledge and information on facilities involved in scientific and technological programs that relate to hazards and emergency programs. In developing the referral database, the activities of the STIS staff will include:

- o Structuring a subject catalog in order to classify, in detail, the types of services and informational databases that are contained in the referral file.

- o Structuring (as in the development of the talent bank) an on-going procedure for information exchange with FEMA controlled and FEMA supported informational elements, Federal libraries, Federal agencies, academic sources, and commercial services so that the STIS is knowledgeable about the information that is available (or the work that is being done) in order to make the referral process productive.

- Developing a method of annotating the information of the referral source file so that significant programs, elements of programs, database contents, etc. can be summarized and identified with key words.

- Developing a cross-index system to locate the best referral source, or combination of sources, to support the STIS client. The index would utilize subject titles, key words, and organization names as locators. As was the case in the development of the talent bank index, during development, thought will be given on the method for making this index adaptable to an automated system.

- Developing a format to provide the required information to the requestor in the most succinct manner. As much as possible, the format will correspond with the format used to process the talent bank information.

- Providing support to clients wishing to use or peruse the referral resource bank whether by correspondence, telephone contact, or personal visit.

- Utilizing the reporting system discussed in the talent bank process to record the number of requests, types of requests, subjects of requests, etc. so that an effectiveness evaluation can be made periodically.

The task details for this STIS model are indicated pictorially in Figure 5.1.1-2. The conjunction of the tasks with those defined in Section 4.3 (Design and Organization of a Talent Bank) and illustrated in Figure 4.3-1 is indicated.

5.1.1.2 STIS Clients

The limited size of this STIS option and its manual operational methodology precludes providing service to a wide user base. Its clients would primarily be those that can conveniently visit the STIS in person — and possibly peruse the files in person. As a practicality, this STIS model would be used mainly by FEMA personnel. To a much lesser extent, the STIS would be used by Federal agencies' personnel located near FEMA or

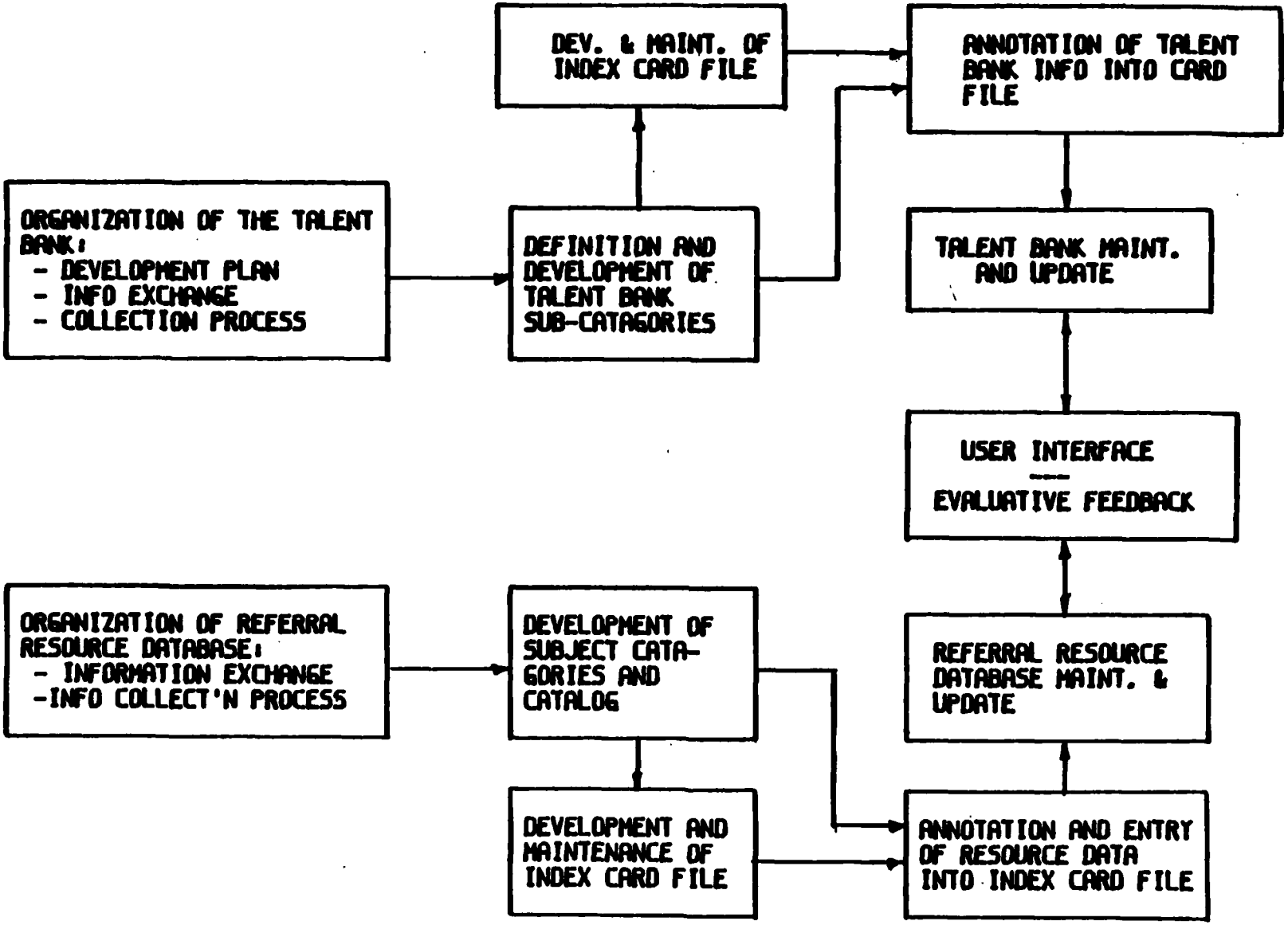

FIGURE 5.1.1-2 MANUAL MODE STIS TASK DETAILS

by consultants working on FEMA related programs. While it would respond to state and local government administrators and practitioners if queried, its obscure position within FEMA would probably not attract many inquiries from the rank-and-file public sector practitioner. Because of its limited outreach it would probably be unknown outside of other FEMA controlled and FEMA supported information centers.

5.1.1.3 Staff and Staff Support

In keeping with the limited scope of this STIS model, the staffing budget will be restricted to supporting a senior professional, a junior librarian and a full-time clerk/typist. The responsibilities and activities of each of the staff would be:

- Senior professional (scientific or engineering background) - Will be responsible for (a) the administration of the STIS, (b) organizing and planning of the STIS operation, (c) interfacing with all external information centers, libraries, talent bank information sources, etc., and (d) collecting the information for the talent bank and referral resource file.
- Junior librarian - Will be responsible for (a) organizing a card catalog system and an indexing methodology, (b) summarizing the contents of each talent bank and referral resource record into the card file format, (c) maintaining and updating the card catalog, and (d) helping users, if necessary, to obtain file information.
- Clerk/typist - Under the supervision of the librarian will type the catalog file cards as well as type and file all STIS correspondence.

5.1.1.4 Required Facilities

The facility needs of this STIS model are modest. Because most of the client contact will probably be made by visits to the files, the STIS needs to be maintained in a closed office area. Since there probably will not

be many people using the STIS files at the same time, the office space need not be larger than that necessary to accommodate the professional staff of two people, a clerk/typist and two potential visitors. An area of approximately 400 square feet would be the minimum requirement.

The furniture and office equipment requirements of this spartan STIS can be limited to (a) the desks and chairs of the professional staff and the clerk/typist (b) a table and chairs for visitor conference and file study, (c) two file cabinets to contain correspondence and office materials, (d) two library-like card catalog file cabinets, and (e) two typewriters.

5.1.1.5 Where in FEMA?

The limited nature of this STIS model suggest that its primary use will be by FEMA personnel involved in research and development plans and programs. The STIS should therefore logically be housed in, and be the responsibility of, the National Preparedness (NP) Programs Directorate or the State and Local Programs & Support (SLPS) Directorate.

5.1.1.6 Start-up and Coninuing Budget

Differing from the private sector, budget centers at FEMA such as directorates do not have to account for the overhead costs of employee fringe benefits, space and utilities utilization, general office furniture and equipment usage, etc. The budget for this STIS model is thus confined to (a) the salaries of the STIS staff and (b) the travel expenses that are necessary to introduce the FEMA STIS concept and interchange talent bank and referral data with information centers that are not located in Washington. Assuming the immediate implementation of the staffing complement and also

immediate travel, the budget elements for start-up and continuation of this STIS model would include:

- The annual salary of the senior professional staff - estimated to be $ 50,000.
- The annual salary of the junior librarian — estimated to be $ 19,000.
- The annual salary of the clerk/typist — estimated to be $ 12,000.
- Estimate of first year travel expense - $12,000; estimate of follow-up visits in subsequent years - $5,000.

Thus, the start-up budget is estimated at 93,000 with a subsequent annual budget at 86,000 without adjusting for salary growth.

5.1.1.7 Level of Response to Program Objectives 2 - 4

It was stated that each option will be judged on its response to the program objectives paraphrased in Section 5.0. In considering this option, it is obvious that it barely meets the program objectives:

- Access and interchange information bases among FEMA controlled and FEMA supported informational elements.

  This STIS is structured to use information from the other informational elements but has little of its own to interchange with others. On a scale of 0 - 10 (with 0 being least responsive to the program objectives paraphrased in Section 5.0 and 10 being most responsive), this STIS is subjectively rated a 3.

- Include assets which exists outside of FEMA. This STIS would use the assets of other informational centers but this simple model would not lead, or be involved in, a coordination activity to develop operating standards. This STIS model is subjectively rated a 2 on this program objective.

- Implement a rapid response interactive system. By the use of additional tools (a computer), the basic information available in the STIS model can be provided on-line. The STIS model is rated a 2 on this objective.

5.1.2 Manual Referral and Library Service

Figure 5.1.2-1 depicts an STIS option which is an extension of the simple model discussed in Section 5.1.1 In this STIS the manually operated talent bank and referral information files are augmented by a collection of scientific and technical published materials and FEMA generated reports. This added feature permits a researcher to peruse the text of the latest available documents or reports known to FEMA, as well as make use of the STIS data files.

As a collection it is not intended to duplicate or replace the FEMA library. Rather, it is intended to supplement the present holdings and be part of the FEMA library. It is suggested as an STIS option because the need to collect STIS file information will mandate a stronger interaction with FEMA supported and/or controlled information centers and other external Federal libraries, than presently exists in the FEMA library operation. This interaction therefore provides an opportunity for enhancing the FEMA library collection while making the STIS a more viable FEMA operation. While not drastically changing the services and targeted clients of the STIS from the first model, the addition of the collection does add some activities to the operation, modify the staff and space requirements, and alter its probable location within FEMA.

5.1.2.1 STIS Tasks

The codes of service, activities, and users shown in Figure 5.1.2-1 are similiar to those indicated in the first STIS model with the addition of code D6 — setting up a library of published documents and a vertical file of unpublished reports and materials. The tasks that must be per-

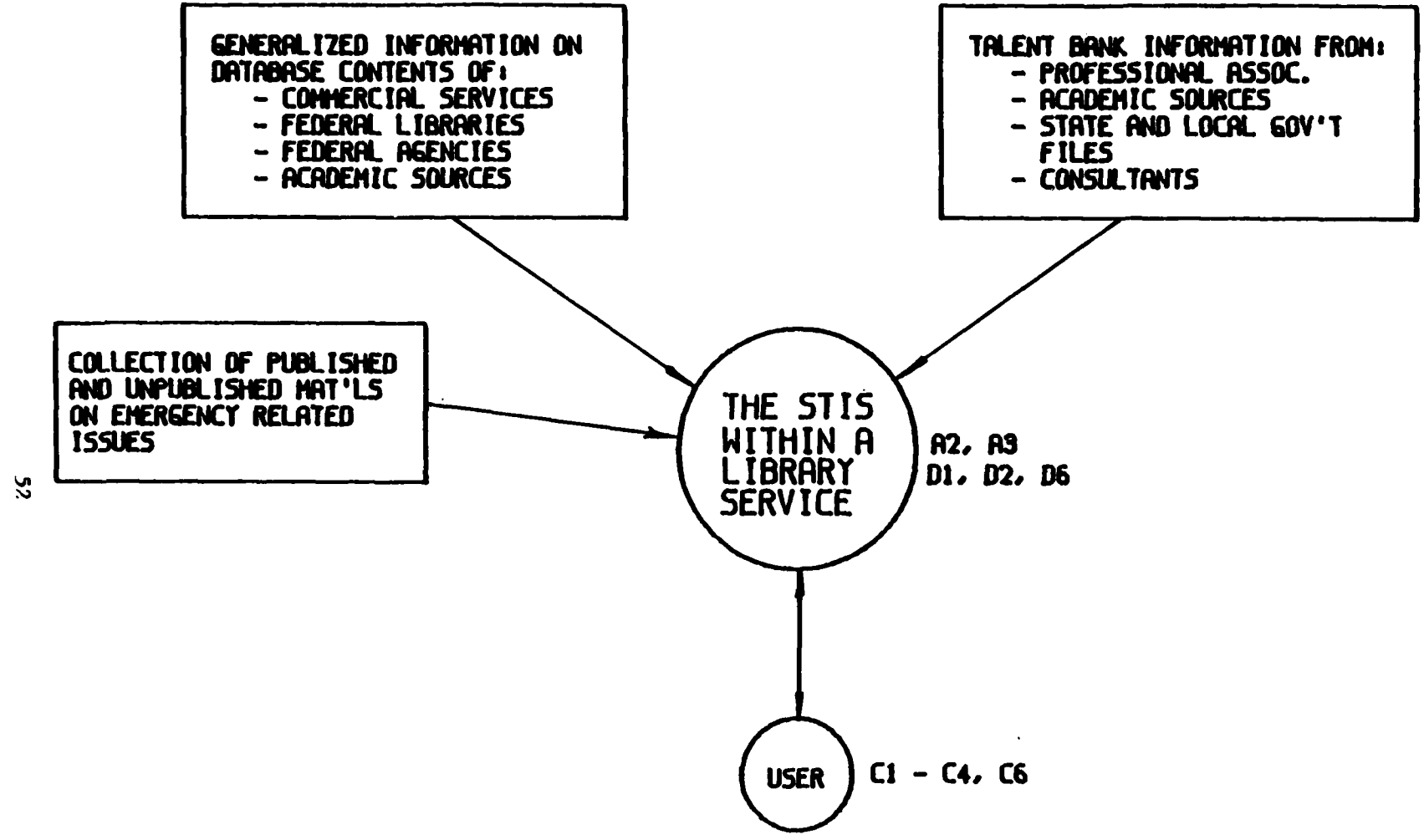

FIGURE 5.1.2-1 MANUAL REFERRAL & LIBRARY SERVICE

formed by the STIS staff are indicated pictorially in Figure 5.1.2-2. They include all the tasks defined in Section 5.1.1.1 (the first STIS model) as well as the following:

- Developing an acquisition system to acquire published books. The acquisition process will periodically scan the literature and publishers information catalogs and set up a procurement process to acquire new library holdings which are relevent to scientists and technologists.

- Developing a formal methodology for obtaining multiple copies of all published and unpublished scientific and technological reports and materials (maps, models, training and education materials, audio-visual, etc.) developed within FEMA as soon as they are complete. Multiple copies are required as barter material for cooperative sharing arrangements.

- Organizing cooperative sharing arrangements with other FEMA controlled and FEMA supported information centers and other Federal libraries and agencies, to obtain unpublished reports and materials which would be of interest to scientists and technologists involved in hazards and emergency related subjects. Materials would include area maps and system models.

- Developing, maintaining, and updating a catalog and index of all holdings acquired through procurement and cooperative agreement.

- Shelving the published literature and storing the unpublished reports and materials so that they can readily be accessed for use by the STIS clients.

5.1.2.2 STIS Clients

As in the previous STIS model, because of its size, this STIS is designed for a limited target client group. It is intended for FEMA personnel involved in research and development planning and training and education. It is also intended for other Federal agencies' personnel who (a) are involved in hazards and emergency related programs (b) could make use of the holdings of this specialized library, and (c) who are located in the Washington area. While the materials of the library would be

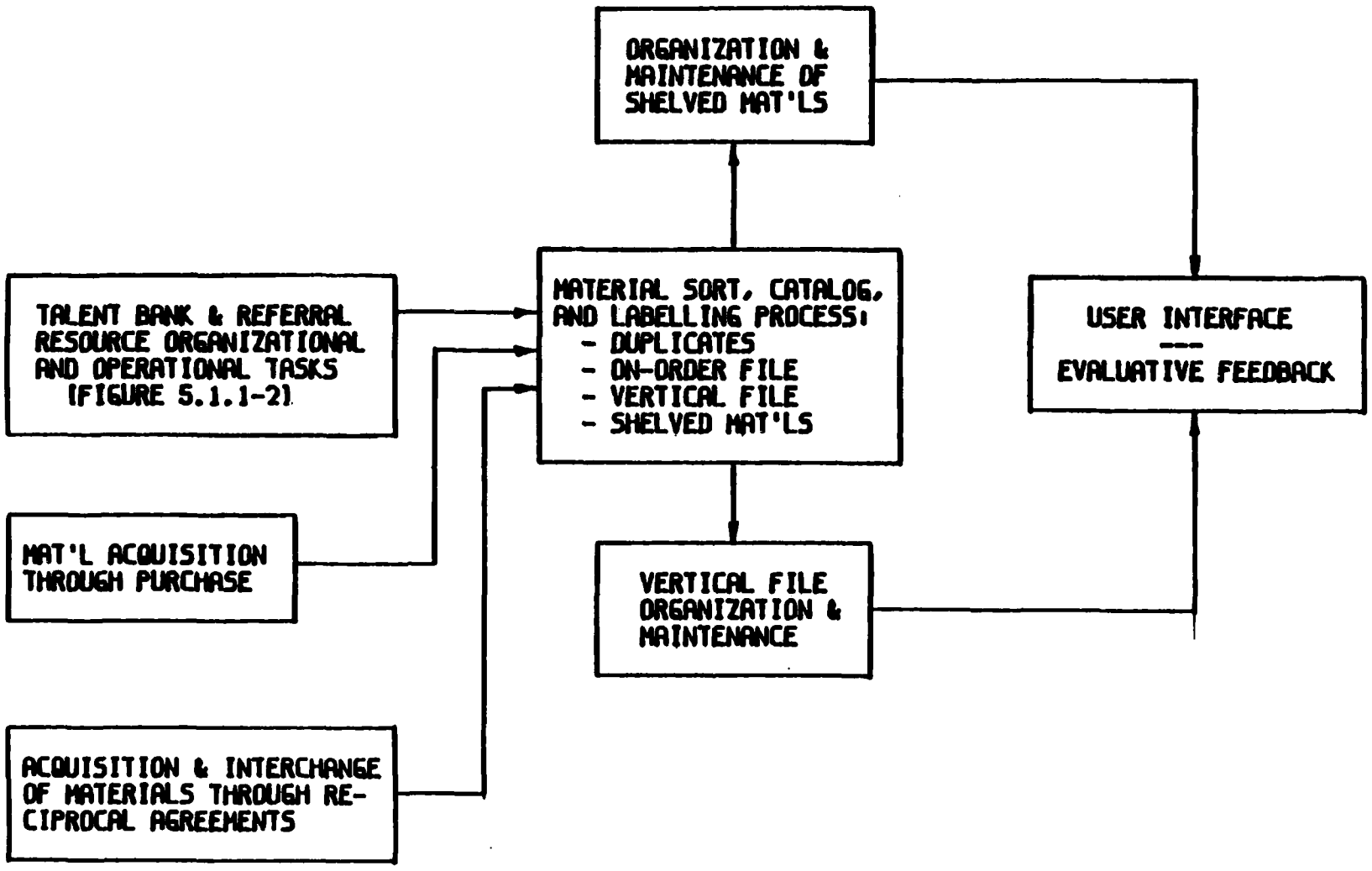

FIGURE 5.1.2-2 MANUAL REFERRAL & LIBRARY MODE TASKS

available to a visitor who would use the materials at the FEMA site, there will be no provision for material borrowing by an individual. The borrowing courtesy will be extended to a cooperating FEMA controlled or supported information center, a Federal library, a Federal agencies' information center and to FEMA research contractors.

5.1.2.3 Staff and Staff Support

The increased activity of this STIS as compared with the simpler manually operated information referral STIS necessitates another full time professional — a librarian. The staff division of work would thus be divided as follows:

- o A senior professional (with a background as a scientist or engineer) who will be administratively responsible for the STIS and for (a) system planning, (b) coordinating with other information centers and libraries, and (c) collecting data for the talent bank and the referral source file.
- o A senior librarian who will be responsible for organizing, maintaining, and updating the library. The librarian will be responsible for all the activities enumerated in Section 5.1.2.1.
- o A junior librarian who will be responsible for (a) organizing a card catalog system and an indexing methodology for the talent bank and referral resource file (b) summarizing the contents of each talent bank and referral resource record into the card file format, (c) maintaining and updating the card catalog, and (d) helping users, if necessary, to obtain file information.
- o A full time clerk/typist who will type the contents of the catalog cards of the resource files and type and file all correspondence.

5.1.2.4 Required Facilities

Because of (a) the anticipated shelving, (b) fugitive file storage requirements, and (c) the reading and study space for visitors, this STIS model will require a greater facility area. Assuming a stand-alone library

(i.e. not a part of the physical facility of the present FEMA library), an area of approximately 1,000 square feet would be needed to house the staff, the STIS service center and library, and the reading room.

The furniture and office equipment requirments of this STIS are similiar to those of the previously described STIS (Section 5.1.1.4) with the addition of library furniture. These additions would include approximately 200 square feet of shelving for books, five cabinets (four-drawer high) to serve as fugitive file storage, two large tables and ten chairs to provide reading and studying room convenience.

5.1.2.5 Where in FEMA?

Because of the close relationship of the holdings of this STIS model to the existing FEMA library, the STIS should be organized as an intergral part of the central library. In fact, it should assume leadership of the present library service. Assuming this responsibility would consolidate and strengthen the capabilities and utility of the FEMA library and permit a joint STIS-FEMA library staffing.

5.1.2.6 Start-up and Continuing Budget

The STIS components that affect the budget include (a) staff salaries, (b) travel expenses, and (c) monies to procure library publications. The first two elements, with the exception of the senior librarian's salary, were estimated in Section 5.1.1.6. This additional salary is estimated to be $30,000 annually.

The expenditure to start the desired collection (or augment the present FEMA library holdings) is estimated at $7,500. This would obtain approximately 200 books (at an average cost of $35 per book). The continuing

annual budget for publications should be estimated at the $2,000 level to increase the holdings of the FEMA library respectfully.

The start-up budget of this STIS is therefore estimated to be $130,500 with a subsequent annual budget of $118,000 (without allowing for salary increases).

5.1.2.7 Level of Response to Program Objectives 2 - 4

The subjective ratings of response of this STIS option to the objectives posed in Section 5.0 are as follows:

- Access and interchange of information bases among FEMA controlled and FEMA supported informational elements. Because this STIS model would collect internal scientific and technical reports, it would have something to offer in an interchange process. This STIS model is therefore given a rating of 5 for partially meeting this objective.

- Include assets which exist outside of FEMA. There is an improvement in the rating of this STIS over the first model because it has incorporated some interchange capability. The size of the staff precludes any major coordinating activity (with other information centers, Federal libraries, or Federal agencies) to develop common operating standards or procedures. The STIS is rated a 4 on this program objective.

- Implement a rapid response interactive system. There has been no change in this STIS model over the first STIS to implement computer techniques to facilitate data retrieval or achieve an interactive user mode. This STIS model, as the previous STIS, is subjectively rated a 2 on this objective.

5.1.3 Automated Stand-Alone STIS

Figure 5.1.3-1 depicts an STIS option that adds an automated feature to the manually operated STIS discussed in Section 5.1.1. Computer usage, which obviously can be implemented in many elegant ways, is primarily

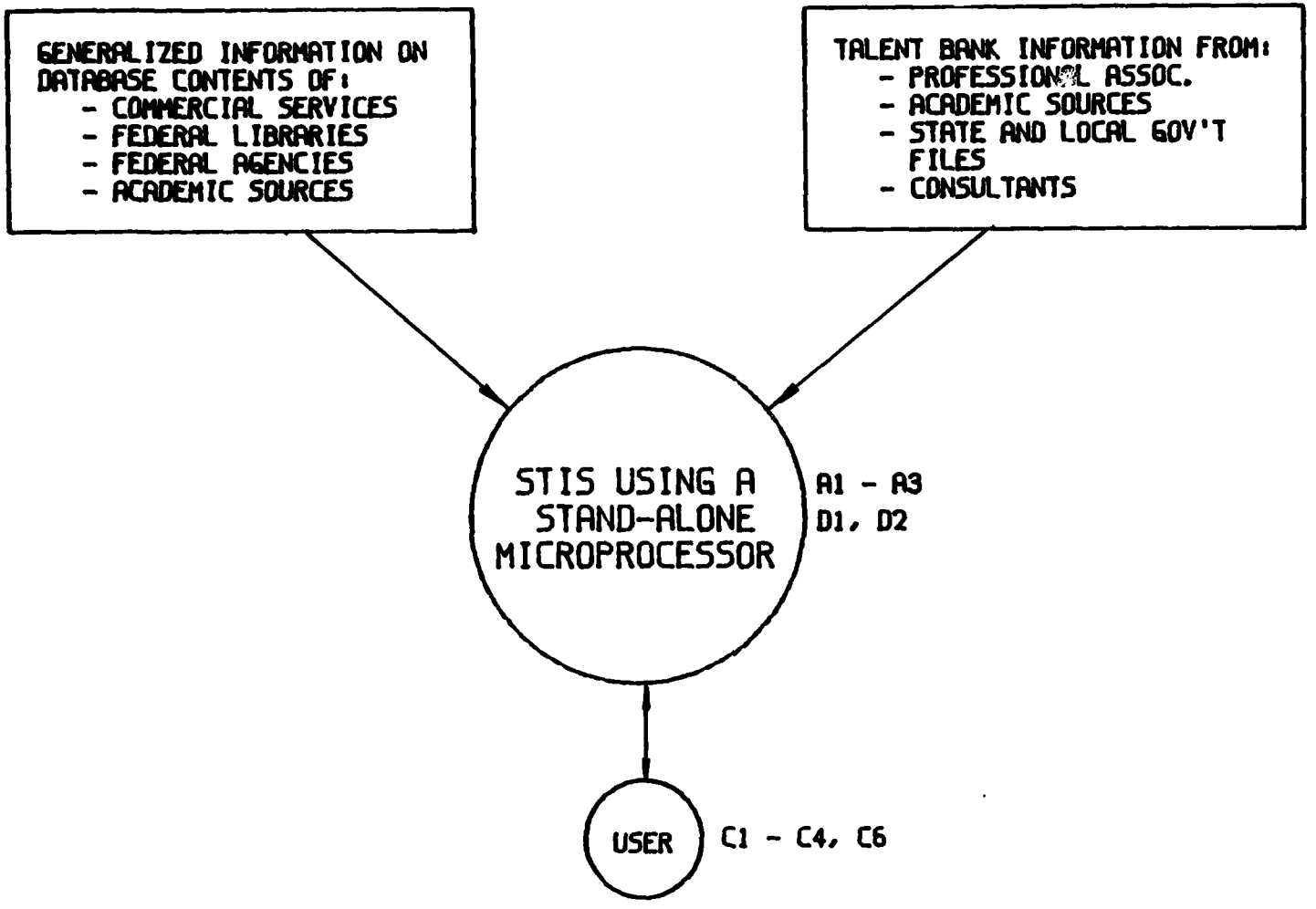

FIGURE 5.1.3-1 AUTOMATED STAND-ALONE STIS

suggested in this model as a substitute for the manual catalog file of the first STIS. The intent is to configure an STIS option which makes use of the minimal and the most basic computer system effectively. The premise for configuring this minimum system is to show that even at the lowest automated level, computer usage is significant to productivity. The characteristics that recommend even the most minimal automation are as follows:

- Good microcomputer equipment in a stand-alone configuration and accompanying software is available at a reasonable price.
- The storage capacity of personal computers is compatable with the anticipated size of an STIS whose function is primarily that of a referral source. This is especially true if a compromise is accepted -- not all the talent bank and referral information is required to be on-line at the same time. This compromise assumes that the system would accept the degraded performance of having to mount different "floppy disks" to access different elements of the database. Thus the user would accept a slow on-line search system. Logic then assumes that because the number of informational transactions is limited, the STIS can effectively service one user at a time without negative reaction from other users.
- Microcomputers are now becoming standard office equipment at FEMA and therefore, their usage would be readily accepted in an STIS environment. There would be little resistance to such a procurement, or better yet, one may be made available from the FEMA office equipment pool.
- FEMA personnel have adapted themselves to using prompted computer software systems such as word processors and therefore can easily be trained to utilize a database system which make use of prompts.
- With the addition of a modem, the microcomputer could also be used as a terminal which can dial-up and utilize commercial services such as DIALOG or ORBIT to perform bibliographic searches of files such NTIS (scientific and technical reports) and/or ERIC (education and training) and provide potential external linkage to other information centers.

The groundrules for considering this STIS option is predicated on the logic that present-day microcomputer hardware configurations are designed to adequately meet the minimal requirements of an automated system. The top-of-the-line models are so designed. If this STIS option were implemented, consideration will be given to the use of 16-bit machines (IBM PC or XT, TRS 80 Model 16, or equivalent) which have 512K byte internal memory and a built-in hard disk drive or have the capability to be attached to a hard disk drive. As a stand-alone machine, the 8 - 10 megabyte hard disk storage will probably have to be supplemented by the use of several floppy diskettes in order to contain the contents of both resource files. In a more elegant configuration (but still a variation of a stand-alone microcomputer utilization), the resource files would be stored in the FEMA main frame computer and when needed by the STIS, a portion of the resource file would be downloaded into the microcomputer external memory (the hard disk).

5.1.3.1 STIS Tasks

The codes of service, activities, and users shown in Figure 5.1.3-1 are similiar to those of the first STIS model with the addition of Code A1— the provision of an on-line search capability within the STIS. The tasks that are to be performed by the staff for this STIS model are indicated pictorially in Figure 5.1.3-2. The tasks are additions and modifications of tasks defined in Section 5.1.1.1 (the first STIS model) and illustrated in Figure 5.1.1-2. The differences in tasks between the two STIS models are (a) the manual and automated methods of organizing the resource file systems and (b) the method of information retrieval. In this STIS model, because of automation, the user would have the advantage of an on-line file search system.

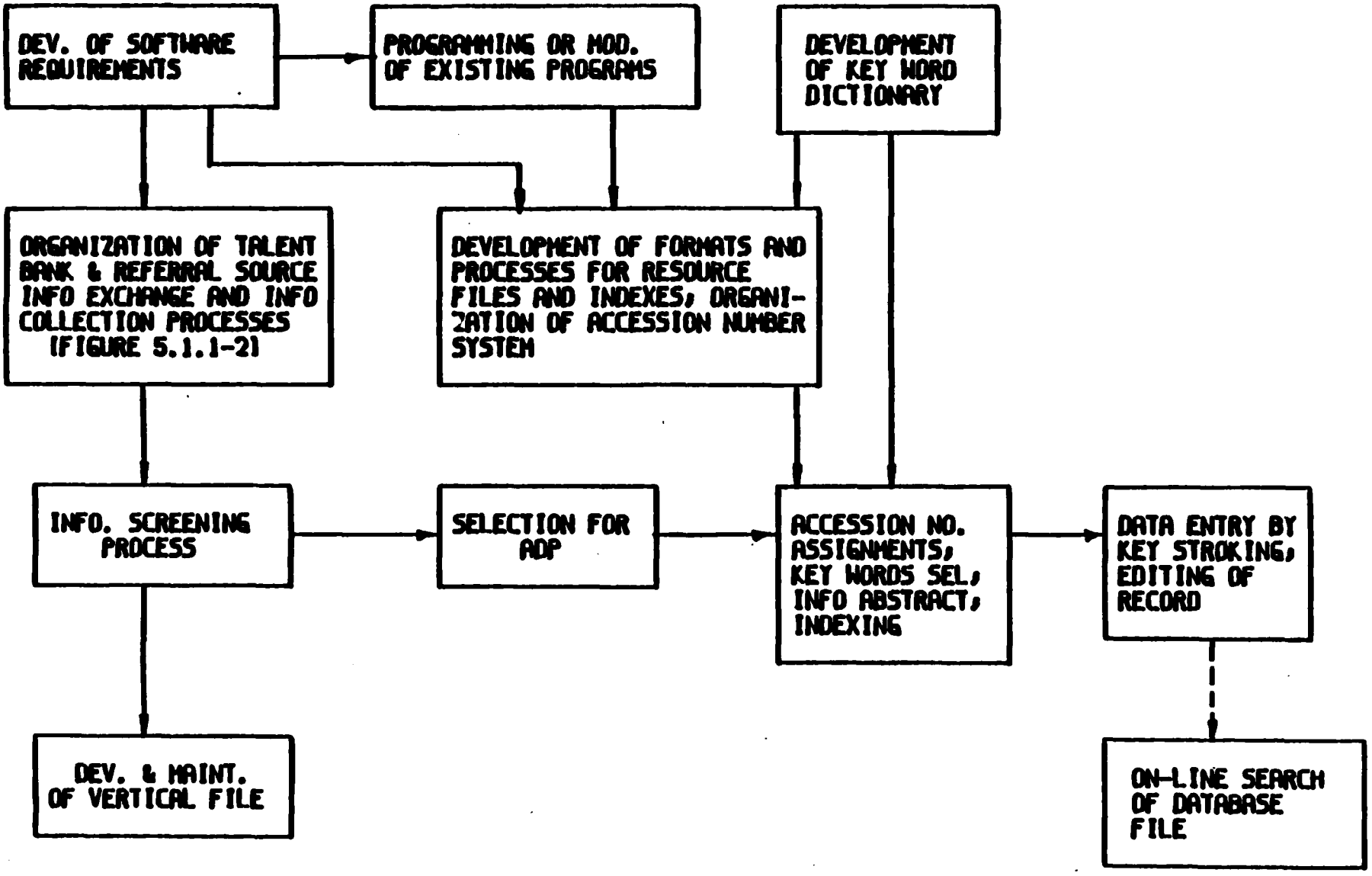

FIGURE 5.1.3-2 AUTOMATED MODE STIS TASK DETAILS

The major additional tasks necessary to incorporate and implement this computer capability include:

- Development of software requirements. Prior to implementation of an automated system, consideration will have to be given to aspects of computer interactive use in order to mechanize a system that is user-friendly. Consideration will have to be given to the contents of the files, how they are to be used, and how to implement displays and prompts so that an untrained (in computer science) technician can use the system without trepidation.

- Organization of software. To develop an automated system, software to organize and effectively search the file(s) will have to be developed or procured. During the development stages of automating this STIS, consideration will have to be given to the best and most reasonably priced method of obtaining the desired system program(s). Potential compromises will have to consider (a) the use of commercially available database management software packages, (b) the development of new software (using a high level language such as COBOL, FORTRAN, or BASIC or using assembly language), or (c) the possibility of modifying an existing program(s).

- Development of formats. Consideration will be given to the structure of the fields of the file to optimize the packing density of the record and to optimize the search process.

- Organization of an accession number system and a key word dictionary. To facilitate the search process, an automated indexing system will have to be developed. The indexing will feature identifying a record by its unique number and by its characteristics (key word identifiers). Both types of identifiers will have to be organized into the system in developing the software and the records formats. To simplify the process of summarizing the information of a resource record, standard key words will be used as much as possible. A dictionary of these conventional key words will have to be developed.

- Organization of an on-line search process. The use of a microcomputer may necessitate the implementation of a multi-disk storage and the organization of a system to locate and use the segmented information. Software to prompt the user in locating and mounting the proper diskette will have to be developed.

- o Organization of an information screening process. As indicated in Figure 5.1.3-2, as part of the organization and maintenance of the files, the information collected for the talent bank and referral resource files will be screened prior to entry into the automated files. Information not deemed complete or worthy of entry will be retained in fugitive files.

- o Data entry and edit check. Information that is passed through the screening process will be assigned an accession number, will be abstracted, and will be "pegged" with key words. The abstracted data will then be entered into the computer. After entry, each record will be printed out in text form as an editing check.

5.1.3.2 STIS Clients

It is anticipated that the on-line search capabiltity added to this STIS model option would attract more users -- but from the same targeted user groups. Because of the size of the STIS and the ability to respond to only one request at a time, however, the targeted user groups would still have to be the same as that assumed for the manually operated STIS model (Section 5.1.1.2). Thus, its clients will still be those that can conveniently visit the STIS in person. The user group will be mainly FEMA personnel, followed by nearby Federal agencies' personnel who are aware of the STIS because of their working relationships with FEMA. As in the manually operated STIS, because of its limited outreach, it will probably be unknown outside of other FEMA controlled and FEMA supported information centers and would get few inquiries outside of Washington.

5.1.3.3 Staff and Staff Support

To add the sophistication of an automated data processing system to the STIS, an additional staff member will have to be added above the staff complement of the manual operated system (Section 5.1.1.3). This additional member would be required full-time during the development of

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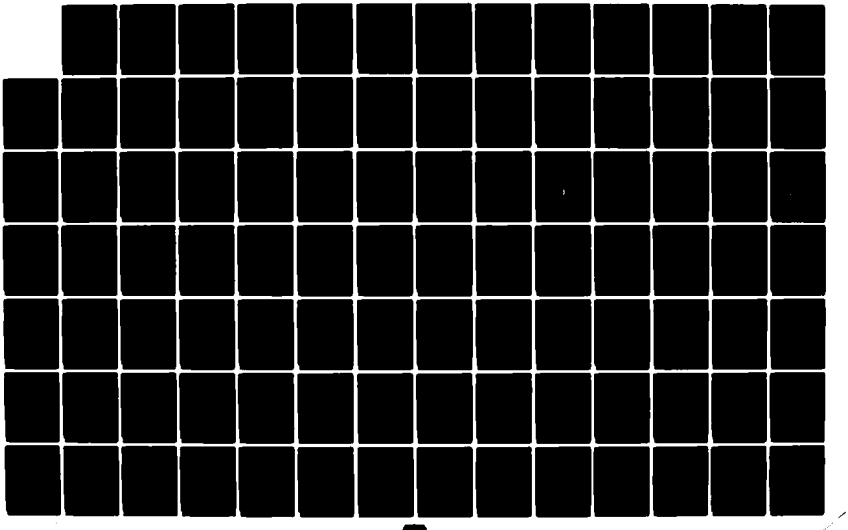

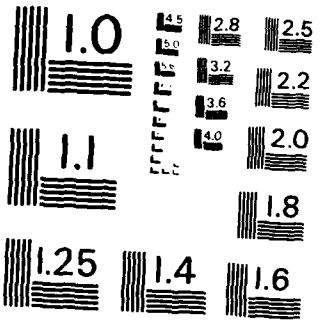

this STIS model and part-time subsequently. As a minimum, this new member will have to be capable of programming using a high level language. Ideally, he/she will have had an information systems background with (a) experience in, or knowledge of, database management systems, (b) the organization of formats and menus for data files, and (c) optimal data sort and search procedures. The total staff complement would thus include:

- A senior professional (with a scientific or engineering background) who will be (a) administratively responsible for the STIS, (b) responsible for organizing and planning the STIS operation, (c) responsible for collecting the information for the talent bank and referral resource file, and (d) responsible for organizing a rudimentary key word dictionary.

- A system analyst and programmer who will organize and support the on-going database maintenance and update process.

- A junior level librarian who will be responsible for controlling the data entry and retrieval process. This staff member will (a) assign accession numbers to the records, (b) abstract the talent bank and referral resource information, (c) support the clerk/typist in keying the data into the computer, (d) edit the contents of the record after it is inserted into the resource file and (e) support the user by doing on-line searches of the STIS resource files or commercial bibliographic databases.

- A full time clerk/typist whose primary job will be to key the abstracted information of the resource records into the computer. The clerk/typist will also type and file all correspondence.

5.1.3.4 Required Facilities

As in the case of the manually operated referral service STIS configuration (Section 5.1.1.4), the facility needs of this STIS model are modest. The office space needs of approximately 400 square feet estimated for staff housing and STIS-user transactions of the simplest STIS is probably also adequate for this STIS configuration.

The office equipment of this STIS configuration are equally modest (no collection of hard copy materials exist in this model).
To the complement of furniture and equipment of the simplest STIS model (Section 5.1.1.4) needs only be added stand-alone computer equipment discussed in Section 5.1.3. The computer equipment should include a 16-bit CPU microcomputer, a display unit (if it is not part of the microcomputer), a hard disk drive (if it is not part of the microcomputer), a dot-matrix printer, and a high speed (4800 baud) modem.

5.1.3.5 Where in FEMA?

As in the case of the manually operated referral service STIS model (Section 5.1.1.5), the probable major users of this STIS will be the FEMA personnel involved in research and development plans and programs. This logic argues for locating this STIS in the National Preparedness (NP) Programs Directorate or in the State and Local Programs and Support (SLPS) Directorate.

5.1.3.6 Start-up and Continuing Budget

The difference in cost between this STIS configuration and the simplest manually operated STIS option is in (a) the initial purchase of the computer and its peripherals (approximately $7,000 to $9,000 for the type of microcomputer and peripherals described), (b) an annual preventive maintenance service contract expense for the computer and its peripherals (approximately $1,000), and (c) the additional salary of the staff person added to organize the file structures and develop any needed software programs. The analyst/programmer would be a full staff member until the system was fully operational (six months to one year) and then be assigned to the STIS on a part-time basis to improve the system.

The cost items designated as (a) and (b) above may not be considered as FEMA Directorate budget items. They are presented as items of cost to cover the contingency that some budget center in FEMA may have to buy (or account for the use of) the equipment and service. The salary of the analyst/programmer thus may be the only additional Directorate budget consideration. The full-time annual salary of the analyst/programmer is estimated to be $42,000.

The start-up budget for this STIS option (not including the cost of a microcomputer and the desired peripherals) is estimated to be $135,000 the first year. The budget for subsequent years (without adjustment for salary increases) is estimated to be $128,000.

5.1.3.7 Level of Response to Program Objectives 2 - 4

The subjective ratings of response of this STIS model to the objectives posed in Section 5.0 are as follows:

- Access and interchange of information bases among FEMA controlled and FEMA support informational elements. This STIS is structured to use information from the other informational elements but has little of its own generated data to interchange with others. This STIS is rated a 3 on this objective.

- Include assets which exist outside of FEMA. As in the first STIS model, this STIS would utilize data from other sources but would limit its coordination activities with other facilities to obtaining talent bank information and generalized resource data. This STIS model is subjectively rated a 2 on this program objective.

- Implement a rapid response interactive system. The addition of a microcomputer will provide an on-line capability to the STIS database and to commercial bibliographic database resources. The system is limited in storage capacity and speed of search. The STIS model is subjectively rated a 6 on this objective.

5.1.4 Central System - Star Network

The previously discussed STIS models are configurations that are typically identified as information centers. The central system STIS model to be discussed in this section (depicted in Figure 5.1.4-1) differs in that it is configured as a clearinghouse. In a real sense, it is the ultimate clearinghouse model because it is designed to be the national center for scientific and technical information on hazards and emergency related subjects. This STIS model assumes that FEMA would serve as a central:

- Depository of information and materials on hazards and emergency related subjects.
- Developer of a computerized database of information on hazards and emergency related subjects.
- Developer of informational products such as source directories and topical bibliographic collections and newsletters.
- Source of response to all public and private sector inquiries on hazard and emergency related topics. The clearinghouse will be available by phone, by correspondence, and by visit for on-line interactive response and material study.
- Provider of materials (reproduced copies of reports, microfiche, topical research reports, etc.) to support the system user.

Figure 5.1.4-1 suggests that with this STIS model, FEMA would consolidate scientific and technical information on hazards and emergency related subjects that exist as raw material and data in FEMA controlled and FEMA supported information centers, at other Federal agencies, state and local government agencies, academic libraries, professional societies, etc. This information will be abstracted into a central automated database. The STIS will not, however, duplicate information within its data bank that already exists

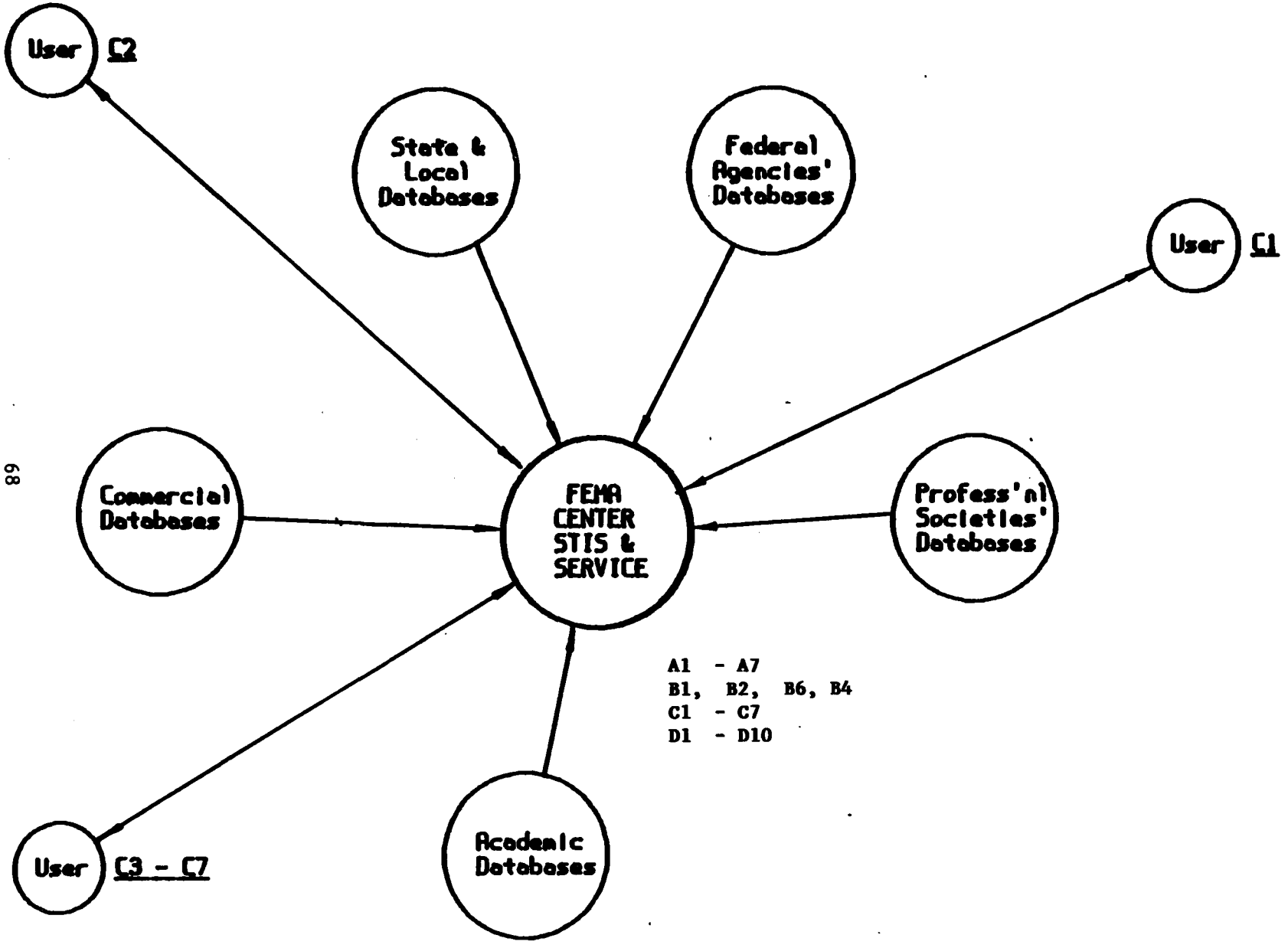

FIGURE 5.1.4-1 CENTRAL SYSTEM - STAR NETWORK

in abstracted form in other facilities and are available to all users. The central system will, on the other hand, contain reference and referral information on the contents of the bibliographic documents and materials that are reported in abstracted form in the other computerized databases. Thus, a user will have access, at one central source, to (a) a database that contains all abstracted or source information on all known scientific and technical topics that relate to FEMA's purpose — hazards and emergency management issues and (b) files of unpublished reports, audio-visual materials, instructional packages and training guides, etc. These would be available for inspection and study.

The computer requirements of a clearinghouse as exemplified by this STIS model far exceed the computer requirements of the previous STIS models. The magnitude of the on-line database that must be immediately accessible and the required ability to respond to multiple inquiries at the same time, mandates the use of a powerful minicomputer dedicated to the on-line search task or a mainframe computer that is partitioned so that a part of the mainframe is dedicated to the on-line search task. Given the size of hazards and emergency related holdings that were found in the needs assessment (Section 4.1) and the library survey (Section 4.2), it is estimated that 50 megabytes of hard disk storage should be immediately allocated and provisions made for expansion. This storage base would contain (a) a cross-index of the contents of all files, (b) the key word dictionary used by the abstractors, (c) the in-house document abstracts developed by the STIS, (d) citations of all material holdings of the STIS, and reference and referral citations of the resource directories (bibliography, talent bank, etc.).

The staff activities of this STIS model increases and broadly expands the activities described in the previous models. The activities are also intended to support a much more diverse client group. The activities are also intended to provide more products and much fuller support to the user of the STIS. To the previous codes of services, activities, and users are now added new ones (Figure 5.1.4-1).

Service

- A4 - Provision of periodic bulletins and a newsletter
- A5 - Provision of electronic mail
- A6 - Provision of reproduced copies of reports; microfiche copies of reports; magnetic tapes of files
- A7 - Research of fugitive files and databases to prepare reports

Coordination Functions

- B1 - Involvement in the organization of guidelines for information interchange and exchange.
- B2 - Involvement in the organization of a universal lexicography for hazards and emergency management usage. The standard key words in the dictionary are to be used in indexing the file information.
- B4 - Organize an electronic mail network
- B6 - Promote information exchange between Federal agencies and other technical information centers.

Class of Users

- C5 - Other state and local government officials
- C7 - Graduate students
- C8 - The general public

Internal Activities

- D3 - Collection of abstracts, reports, books from other information centers and Federal agencies
- D4 - Development of criteria for (a) entry to databases, (b) storage in fugitive files, (c) material elimination, etc.

- D5 - Organization and maintenance of a catalog, index, and abstraction of item D4 materials

- D8 - Process and edit control of item D7 materials

- D9 - Organization and maintenance of the material dissemination process

- D10 - Organization and operation of a self-evaluation system to dynamically improve the STIS

The large number of newly identified codes in Figure 5.1.4-1 are indicative of the magnitude of additional tasks and services that a clearinghouse performs and provides compared with an information center.

5.1.4.1 STIS Tasks

Figure 5.1.4-2 illustrates the clearinghouse activity interaction. It illustrates that the tasks of this STIS model fall into the following categories:

- o Coordination with all FEMA controlled/operated information centers, Federal libraries, other Federal agencies' information centers, academic libraries, etc., to collect hazards and emergency related materials.

- o Development of procedures and controls so that all clearinghouse processes operate effectively and efficiently.

- o Development and maintenance of facilities to support the user in the most expeditious manner. These facilities include an automated database, fugitive files, a standing library of hazards and emergency related books, microfiche documents, audio-visual materials, etc.

- o Development of products to optimize the STIS client service. These products extend beyond on-line search activities and include development of (a) source directories of the STIS files, (b) topical bibiographic reports, (c) topic research and the preparation of a periodic newsletter.

- o Organization and maintenance of a product dissemination and distribution process. This process includes distribution of the newsletter and source directories and dissemination of hardcopies of original reports and microfiche materials, etc. It includes dissemination of daily information via an electronic mail network.

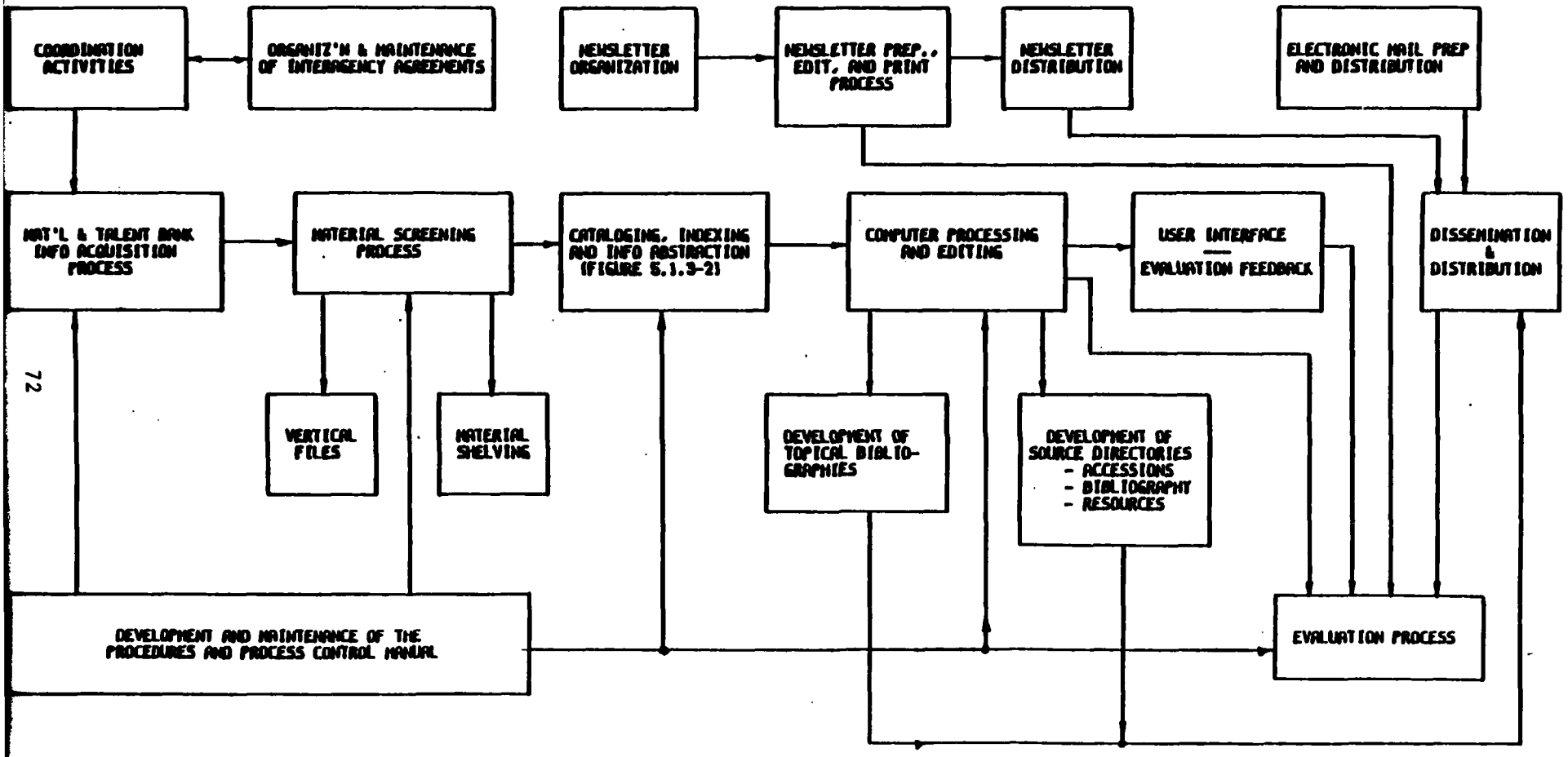

FIGURE 5.1.4-2 CENTRAL CLEARINGHOUSE TASKS

The following sections detail these task categories.

5.1.4.1.1. Coordination Activities

The concept of this STIS option is that FEMA serve as the unifying, central clearinghouse for scientific and technical information on hazards and emergency management issues. This is not to imply that all present collections of hazards and emergency related materials and information dissemination processes are to be subsumed under this STIS model. That scope would be too vast and unacceptable to other interested groups. Rather, the concept would be that the central STIS would be responsible for developing a computerized database of the published scientific and technical documents in the hazards and emergency management field to insure that information on all published documents be available on-line to all potential users. Information which is already on-line and available through networking will be identified in the database but will not be abstracted again.

The STIS model which is a clearinghouse would thus incorporate within one database the information of other existing information centers. And because it is structured to be the central service agency, it will serve as the linkage between these diverse information centers (who until now have not had a unifying agent). Individually, they have had limited resources to develop a unified scientific and technical database focused on hazards and emergency management information. As indicated in the needs assessment (Section 4.1) and the survey of facilities that contain emergency related holdings (Section 4.2), general applicable material has been collected by many libraries and information centers. Specialized materials have been

collected by several facilities such as the Center for Fire Research (National Bureau of Standards), the Disaster Research Center (Ohio State University), the Center for Technology, Environment, and Development (CENTED) at Clark University- and the Natural Hazards Research and Applications Information Center (University of Colorado).

The coordination activities of this STIS model are refinements and extensions of the process considered in the STIS model which incorporated a library service (Section 5.1.2). That model required cooperative information sharing agreements to obtain copies of the holdings of other information centers. The refinements in the coordination process of this model center on how to collect numerous holdings, as well as on how to unify use of the individual holdings. To that end, one senior staff person would be involved in the organization of guidelines for material and information interchange and exchange. The understanding would be that the STIS would not take away any responsibilities from the other information centers but would be the central clearinghouse linking all the information centers. Thus, it would be an instrument in promoting information exchange between Federal agencies and other technical information centers.

The assumption that this STIS model will be one of several facilities that will separately prepare bibliographic and resource abstracts for common usage suggests that all the information services would be better served if all agreed to the organization of a universal lexicography for hazards and emergency management usage. Because of its assumed central role, this STIS should be the driving force in the coordination process to achieve

this standardization. The senior staff person who is responsible for coordination in this model also has to be technically qualified to support the effort to develop a key word dictionary.

5.1.4.1.2. STIS Activities and Process Manual Preparation

This STIS option involves many more activities and requires a much larger staff then previously discussed models. Figure 5.1.4-2 illustrates the variation in activities and their interrelationships. Beyond the more complex coordination process (Section 5.1.4.1.1), new activities or refined elements of this STIS include:

- An extended screening process which weighs all incoming information to determine (a) whether they are to be processed into the STIS, (b) whether they have already been abstracted elsewhere and only need to be referenced, (c) whether the material or information is filed in a fugitive or discarded, etc.
- Organization and periodic preparation of a newsletter and an electronic mail system.
- Development of documents that would have major utility to STIS clients such as source directories and topical bibliographic collections (further details in Section 5.1.4.1.4).
- The development and operation of an extended inquiry support system where STIS clients are serviced by phone, by mail, and in person (Section 5.1.4.1.5).
- The development and operation of an extended dissemination and distribution system to provide STIS clients with (a) copies of materials available at the clearinghouse and (b) products of the clearinghouse (newsletter, source directories, bibliographic collections, etc.).

As a means of insuring efficient operation in all these activities, formal procedures and control methodology would be defined in a process manual. To be effective, this manual will have to be current in all aspects

of clearinghouse activities. It will have to be continuously updated as evaluation cycles indicate the need for process improvements. It is estimated that it will require one person-year to initially prepare the manual. The refinement and update process would be part of the periodic evaluation and is estimated as a continuous half person-year effort.

5.1.4.1.3. STIS Holdings Process

As indicated in Figure 5.1.4-2 (the Central Clearinghouse Activity Flow Diagram), the screening process will branch material collection into channels of database processing, vertical file collection, and material (books, audio-visual, microfiche, etc.) shelving. In all cases, the material will be cateloged and cross-indexed by use of the STIS accession numbering system so that it can be located by computer. Abstracts of published journal articles and bibliographies will be cross-referenced with STIS accession numbers. Reports and books on hazards and emergency management which have not been entered into any computered databases will be cateloged and abstracted within the STIS clearinghouse.

5.1.4.1.4. STIS Generated Products

To further improve the clearinghouse client service, this STIS option would utilize the information in the computerized database to develop products that can be disseminated to a wide audience. These products are printed documents that unify a segment of the database into a published format. They are intended to be owned by clients and held on their desks or bookshelves as a ready reference of materials available at the clearinghouse. Technical products would include (a) collections of topical bibliographies on specific subjects of interest on hazards control and emergency

management, (b) source directories which cross-reference STIS accession numbers with bibliographic and resource topic information, and (c) reproductions of reports generated by requests for research of a specific topic within the hazards and emergency management field.

As indicated in Figure 5.1.4-2, this STIS model would also develop products that provide newsworthy information about the clearinghouse, its activities, and other generalized topical information (legislation, coordination activities, program status, etc.) related to hazards and emergency management issues. The formats for these products would be a newsletter and electronic mail news bulletins. The former product would be a multipage tabloid published periodically and distributed to all clients desiring copies. The latter product would be written as a collection of news bulletins and distributed electronically by utilizing a commercialized service to network the bulletins to information centers and libraries who are users of the networking service. A full time staff member will be assigned to develop, prepare the text, edit, manage the print processing of the newsletter, and monitor the distribution and dissemination of the newsletter and the electronic mail news delivery processes.

5.1.4.1.5 STIS Client Support Services

As shown in Figure 5.1.4-2 the centralized STIS clearinghouse would provide client support activities ranging from (a) on-line searches of the internal database as well as other available databases, (b) provision of copies of reports and data available in the fugitive files, and (c) research of internal files and the files of other facilities, as well as all known databases, to compile and analyze information on topic(s) of

special interest. The first two services would be provided as a normal procedure of the clearinghouse; the third, being both specialized and ending as a product of the clearinghouse would have to go through a selection process (by a selection board) prior to be initiated by the clearinghouse.

To insure continuous delivery of optimal service and to also weigh the effectiveness of the personnel interfacing with the STIS clients, the clearinghouse would analyze the effectiveness of user service by developing a client follow-up and information feedback process in which the acceptability of service would be measured from the clients' viewpoint. This evaluation process would be used to modify the procedures and process control manual (Section 5.1.4.1.2).

5.1.4.1.6. STIS Products Distribution and Dissemination Services

The multiple products and modes of delivery provided to STIS clients requires a controlled distribution and dissemination process to insure proper and expeditious delivery. The process is also necessary as a way to maintain inventory control of file and shelf materials. In place, the process would maintain control of (a) mailing lists for different products (newsletter, directories, etc.) and (b) multiple copies of reports (FEMA published reports, clearinghouse topic research reports, etc.). The process would be responsible for standard mailouts (newsletters, directories) and client request for materials (copies of requested reports, shelved reports, directories, etc.). The records maintained in the process control will serve as evidence of clearinghouse effectiveness during the periodic evaluation of the clearinghouse.

5.1.4.2 STIS Clients

Differing from the previously discussed STIS options, this model is intended to serve the widest possible client base. As the central clearinghouse of hazards and emergency management information, it would be available to all users and outreach would be emphasized by making a toll free (800-level) telephone line available for incoming calls. It would be designed to accept several simultaneous calls to prevent discouragement because of inability to reach the STIS user service desk.

The clearinghouse would also be designed to respond quickly to mail queries and to initiate telephone contact (or, if not possible, then mail contact) if the query is not totally understood. The clearinghouse would provide assistance to visitors who wish to use the library or the fugitive files. It would encourage the visitor's participation in on-line search activities necessary to respond to a query.

As in the previous STIS options, it is intended that this model be supportive of FEMA and nearby Federal personnel's information requirements. The targeted user group extends beyond Washington, however. Given the population base of potential users, a major segment of clients, with encouragement, would be the state and local government administrators and practitioners involved in emergency management planning. This STIS option would also encourage researchers and graduate students to use the clearinghouse because it is recognized that the work of the former may have utility to all practitioners in the field and the latter user group may become part of the Federal, state, and local government cadre.

5.1.4.3 Staff and Staff Support

Differing from the limited staffing requirements of previous STIS options, the activities of the clearinghouse mandate a significantly larger cadre of professionals. The (a) number involved in a specific activities, (b) responsibilities of individuals or groups of individuals, and (c) activities of the individuals or groups of individuals are summarized as follows:

- A director of the clearinghouse who is responsible for all budget and administration considerations. A secretary and clerk/typist will report to the director to support the activities of the director's office. As part of their activities, they will also support the administrative typing and filing needs of the clearinghouse staff.

- A senior professional (scientific or engineering background) who will be responsible for (a) coordinating clearinghouse activities with other information centers and libraries, (b) organizing and maintaining cooperative sharing arrangements with other information centers and libraries, (c) coordinating the development of a lexicon for a key word dictionary, and (d) collecting data for the talent bank.

- A system analyst/programmer who will (a) develop the software requirements of the clearinghouse database, (b) organize existing, modified, or programmed software to meet the requirements of the clearinghouse, (c) develop the screen formats to simplify the computer usage for the clearinghouse cadre, (d) be responsible for the development of the clearinghouse process manual, and (e) be responsible for periodic evaluation of the clearinghouse process as a step to making improvements in the system.

- A senior librarian who will be responsible for organizing, maintaining, and updating the holdings of the clearinghouse. The senior librarian will (a) develop an acquisition system to acquire published books, (b) follow-up on the cooperative sharing arrangements with other information centers and libraries by obtaining reports, journal articles, and materials germane to hazards and emergency management, (c) develop and maintain a formal methodology for obtaining multiple copies

of reports and materials developed within FEMA, (d) organize and maintain an accession numbering system to permit an indexing system of all database information, fugitive files information and shelved materials subjects, and (e) organize a filing and shelving system to make the library material easily accessible to clearinghouse users.

- Two junior librarians whose tasks are to (a) assign the accession numbers to all incoming materials, (b) prepare the abstracts of the materials to be entered into the computerized database, (c) edit and correct the contents of the database records after they are keyed into the computer, and (d) supervise the two clerk/typists keying the computer database information.

- Four researchers whose tasks are to provide direct support to users of the clearinghouse by (a) helping them, if necessary, in clarifying their queries, (b) providing on-line searches of in-house and external databases for desired information, (c) providing searches of the fugitive files and shelved materials, (d) providing talent bank referral information, and (e) conducting research on specialized topics.

- Two researchers/editors whose tasks are to (a) organize and prepare each issue of the newsletter through its cycle of information gathering, reporting, formating, editing, and monitoring the printing and distribution process, (b) develop the source directories and topical bibliographic collections, (c) organize and prepare the text of the electronic mail bulletins, and (d) assist the system analyst/programmer in the development and maintenance of the clearinghouse process manual.

- A lower level administrator who is responsible for the dissemination and distribution process as well as the inventory control of the clearinghouse. This activity will have the help of a clerk to assist in packing and mailing.

5.1.4.4 Required Facilities and Equipment

Using the staff complement of Section 5.1.4.3, this STIS option assumes a clearinghouse staff of 18 full-time people. The professional position of the staff assumes the need for one large office (for the clearinghouse administrator), four smaller offices for the senior personnel (interagency coordinator, analyst/programmer, senior librarian, and staff member respon-

sible for distribution and dissemination), and three shared offices (among the four researchers and the researchers/editors of the newsletter, directories, etc.). It is estimated that 700 square feet will satisfy the enclosed office space and an additional 800 square feet of open area will satisfy additional staff space and walk-through areas.

There is a facility requirement for a library/conference room (estimated at 600 square feet), a reproduction area (150 square feet), and an enclosed storage, receiving and shipping area (400 square feet). Most importantly, there is a need for an enclosed area for either a minicomputer and its peripherals (a printer, hard disk drives, etc.) or peripherals that permit use of the FEMA mainframe computer (a multiplexer/controller, a high speed modem, and a printer). The computer area needs are estimated to be 150 square feet assuming the need for the larger space requirements of the minicomputer and its peripherals rather than the FEMA mainframe connect-up architecture.

On the basis of these estimates, this STIS model could be housed in a space of approximately 2,800 square feet.

The highly automated configuration of this STIS option requires that the facility be structured around the computer and the electronic work stations. Regardless of whether a minicomputer or the FEMA mainframe computer is used, a minimum of six terminals will have to be connected to (a) the minicomputer and printer or (b) to the multiplexer/controller (which remotely connects to the FEMA mainframe computer) and printer. The terminals, peripherals, and/or minicomputer would be interconnected by a local area network (LAN).

The terminals would be placed at work stations or on the desks of:

- o The analyst/programmer
- o The researchers who interact with users (two terminals)
- o The clerk/typists who key raw data into the STIS database (two terminals)
- o The research/editors who prepare the newsletter, STIS directories, and the electronic mail bulletins

The office and library furniture and equipment would be similiar to those previously described in Section 5.1.2.4 (STIS within a library service) with the addition of (a) a high speed paper copier, (b) more shelving space for books (estimated at 500 square feet of shelving space), and (c) ten rather than five cabinets to store fugitive files

5.1.4.5 Where in FEMA?

The importance and size of the described clearinghouse suggests that this STIS option would function better if it were placed outside the planning directorates (NP or SLPS). Its ideal place within FEMA is as an office reporting directly to the FEMA Director, or as an office within either the Resource Management and Administration Directorate or OP-IR.

5.1.4.6 Start-up and Continuing Budget

Not considering major items of cost such as (a) capital equipment (computer, furniture, etc.), (b) capital equipment maintenance, and (c) facility, which are not charged to a FEMA office budget, the main STIS components that are chargeable as budget items include:

- o Staff salary - As enumerated in Section 5.1.4.3, this STIS option would have a staff complement of 18 people. It is estimated that the annual payroll for this staff would approximate $430,000.

- o Cost of material reproduction and dissemination - To be viable, the clearinghouse will have to be recognized as a source that provides documents (directories, reproduced journal articles, newsletters, reproduced fugitive file materials, FEMA published and unpublished reports, etc.). It is estimated that a budget of $30,000 would be required annually to meet this clearinghouse service.

- o Material procurement - As discussed in Section 5.1.2.6, an estimated $7,500 is needed to start the library collection (procurement of 200 books); the continuing annual budget to increase the library holdings is estimated to be $2,000.

- o Travel expense - Similiar to the rationale of Section 5.1.1.6, the travel budget to (a) coordinate the clearinghouse activities with the other information centers and libraries and (b) initiate cooperative agreements is estimated as an initial first year expense of $12,000 and a yearly follow-up expense of $5,000.

Thus, the start-up budget is estimated at $479,500 with a subsequent annual budget of $467,000 (without adjusting for salary growth).

While not a departmental budget issue, the cost of installing the computer and its peripherals are so significant that they may become the reasons why an STIS option becomes unacceptable to FEMA. With this in mind, consideration is given to these costs in the following discussion.

FEMA has within its inventory both a state-of-the-art mainframe computer and several 32-bit minicomputers (VAX 11/750) which could provide the clearinghouse with (a) high speed search capability, (b) multi-station interconnect capability, and (c) more than required internal and external storage capacity. Use of either system would, however, require dedication of all or part of the system to the clearinghouse needs.

In the case of the mainframe, the following factors would apply. The clearinghouse computer peripherals (high speed modem, multiplexer/controller,

six terminals, two printers, etc.) would be remotely connected to the mainframe computer. The clearinghouse would have partitioned utilization of the mainframe computer. The dedicated portion of the system would be hard disk drives that would be available only to the clearinghouse on an on-line basis. Assuming the need to procure all peripherals and the additional disk drive in order to use the mainframe computer, the cost of ADP components would include:

	Estimates
o Modem (Full dupex, 9600 BPS).....	$ 7,500
o Multiplexer controller.....	4,000
o Two intelligent terminals.....	16,000
o Four terminals.....	8,000
o Two high speed matrix printers.....	8,000
o 48 MB fixed/removable drive.....	25,000
	$68,500

In the case of minicomputer usage, these factors would apply. The minicomputer would be primarily dedicated to the clearinghouse on an on-line basis. As in the case of the stand-alone microcomputer (Section 5.1.3), it would be housed in the clearinghouse facility. The major differences between the microcomputer usage and minicomputer usage are (a) that the former is intended as a single user computer while the latter is intended and designed for multiple users, (b) the minicomputer has the capability of having greater internal storage and higher computational speed (which translates into faster search speeds in the clearinghouse

utilization) because most modern minicomputers are 32-bit CPU machines as compared to the 8-bit and 16-bit CPU microcomputers, and (c) the hard disk drives available for minicomputers have much more capacity than those available for microcomputers. The use of a 48 MB fixed/removable drive (suggested for the FEMA mainframe computer configuration) is applicable to a minicomputer configuration.

The cost of 32-bit minicomputers varies from $60,000 to over $300,000 depending on (a) the speed of computation, (b) the number of users it can support simultaneously, and (c) the size of internal and external memory storage. For the clearinghouse, a minicomputer nearer to the lower end of the pricing scale will suffice. Assuming growth, the clearinghouse minicomputer must be able to support ten users simultaneously, it must have a minimum of 512K main memory, and a 48MB fixed/removable drive. The approximate cost of such a minicomputer configuration would cost $60,000. Given the terminal and printer requirements previously described when using the FEMA mainframe computer, the cost of computer and peripherals approximates $92,000.

The consideration of software cost is minimized because it has been equated in the staff budget and because it is believed that software available at FEMA is adaptable to clearinghouse usage. In considering the clearinghouse staff complement, a full time analyst and programmer were included. It will be the task of the analyst/programmer to (a) adapt existing software packages or in-house programs to clearinghouse needs and (b) develop menus and screens to make computer interaction as user-friendly as possible.

5.1.4.7 Level of Response to Program Objectives 2 - 4

The subjective ratings of response of this STIS model to the objectives posed in Section 5.0 are as follows:

- Access and interchange of information bases among FEMA controlled and FEMA supported information elements. The coordination activity and holdings within the clearinghouse are based on major informational interchange. It is anticipated that this STIS option would be the clearinghouse for information and materials between the FEMA controlled and/or supported information centers. This STIS is rated a 10 on this objective.

- Include assets which exist outside of FEMA. In its most effective mode, this STIS would contain information about all scientific and technical holdings on hazards and emergency management within the (a) Federal agencies' information centers and libraries and (b) academic libraries. As much as possible, this STIS will collect and maintain copies of these holdings. This STIS is rated a 10 on this objective.

- Implement a rapid response interactive system. The description of this STIS suggests the use of the latest minicomputer or the FEMA mainframe computer to achieve rapid on-line information search response to several users simultaneously. This STIS model is rated a 10 on this objective.

5.1.5 Decentralized STIS - Branching Network

The centralized STIS model focussed all activities in one central, federally controlled facility. It is, however, FEMA's intent to de-emphasize centralization by implementing an Integrated Emergency Management System (IEMS) where state, regional, and local governments would assume a major obligation in organizing and managing dual-use (all-hazards) emergency management programs. This philosophy can be extended to STIS options. This section will discuss such a system.

In this STIS model (Figure 5.1.5-1), the activities described in the STIS option for a centralized clearinghouse (Section 5.1.4) would be divided into those that can be accomplished more efficiently at a central site (coordination with all Federal agencies' information centers and libraries, development of a database, collection of materials, etc.) and those that can be accomplished at state, regional, or local government sites. With this concept, regional centers would have access to, or be provided with the contents of the centrally developed database. They, rather than the central clearinghouse would be mainly responsible for interfacing with the targeted clients (state and local government administrators and planners, researchers, graduate students, etc.) who require reference and referral information on hazard and emergency management materials and resources. Because of their proximity to state and local government personnel and academic clients, the regional information centers of this STIS option may be more effective in developing an outreach program to the targeted groups outside the District of Columbia.

To provide the resources needed by the regional information center, the central system (located at FEMA) would retain most of the activities described in the central clearinghouse STIS option (Section 5.1.4). In essence, it would still be a clearinghouse with much of its client interface activities transferred to a linking agent - the regional information center.

An analogy of this linking service can be made in the relationship of any facility with a terminal and modem that utilizes a commercial database service such as DIALOG, ORBIT, etc. via a telephone network. The commercial

services have available, in an on-line interactive mode, the databases developed by public and private sector information centers. Similiarly, this STIS model would collect, process, and make available to the regional information centers (or university libraries), scientific and technical information on hazards and emergency management on an on-line interactive basis via telephone line.

An alternate to this methodology would be one where this STIS model would provide its database to a commercial service so that it is available to any user with the ability to link to DIALOG, ORBIT, BRS, etc. Several advantages accrue from this alternate. First, many agencies and universities utilize the commercial services, and therefore are familiar and comfortable with the connect and search methodology. Secondly, it would permit the clearinghouse to primarily focus on the material collection process and the development of the database.

5.1.5.1 STIS Tasks

The decentralization of the clearinghouse suggested by this STIS option changes the emphasis of some of the coordination and user support activities of the personnel but retains similiar methods of (a) material and data collection, (b) system processing to create the database, vertical files, library holdings, etc., (c) development of clearinghouse products such as the newsletter, electronic mail bulletins, source directories, topical bibliographic collection reports, etc., (d) inventory control, and (e) distribution and dissemination methods. The tasks of the activities are detailed by the following categories.

Coordination Activities

New codes in Figure 5.1.5-1 illustrate the change in coordination activity emphasis. The new codes include:

- B3 - Organization of an emergency management information network with public sector and university facility nodes.

- B5 - Organization of a training procedure and a support mechanism for the regional satellites of the STIS clearinghouse.

The coordination activities of this STIS model are refinements, extensions, and additions to the coordination processes previously described in discussing the central clearinghouse concept (Section 5.1.4.1.1). In that model, the coordination process centered on reaching understanding with other organized information centers and libraries so that scientific and technical reports, materials, and unpublished data in hazards and emergency management could be collected in a central clearinghouse so that it could be more easily be shared by all potential users. One senior staff person was assigned to perform the coordination tasks.

In this STIS model these tasks will have to be performed as well. Additionally, the coordination process would assist the satellite regional information centers in organizing themselves by utilizing a training program. This training will instruct the regional center personnel in (a) information search methodology and (b) interface procedures with users to provide reference and referral service. The training would reduce the start-up time of the satellite centers, speed the staff's learning process, optimize the staff's efficiency, and create uniformity within the regional centers of the network. Two senior staff would be assigned to perform the coordination and training functions of the decentralized clearinghouse.

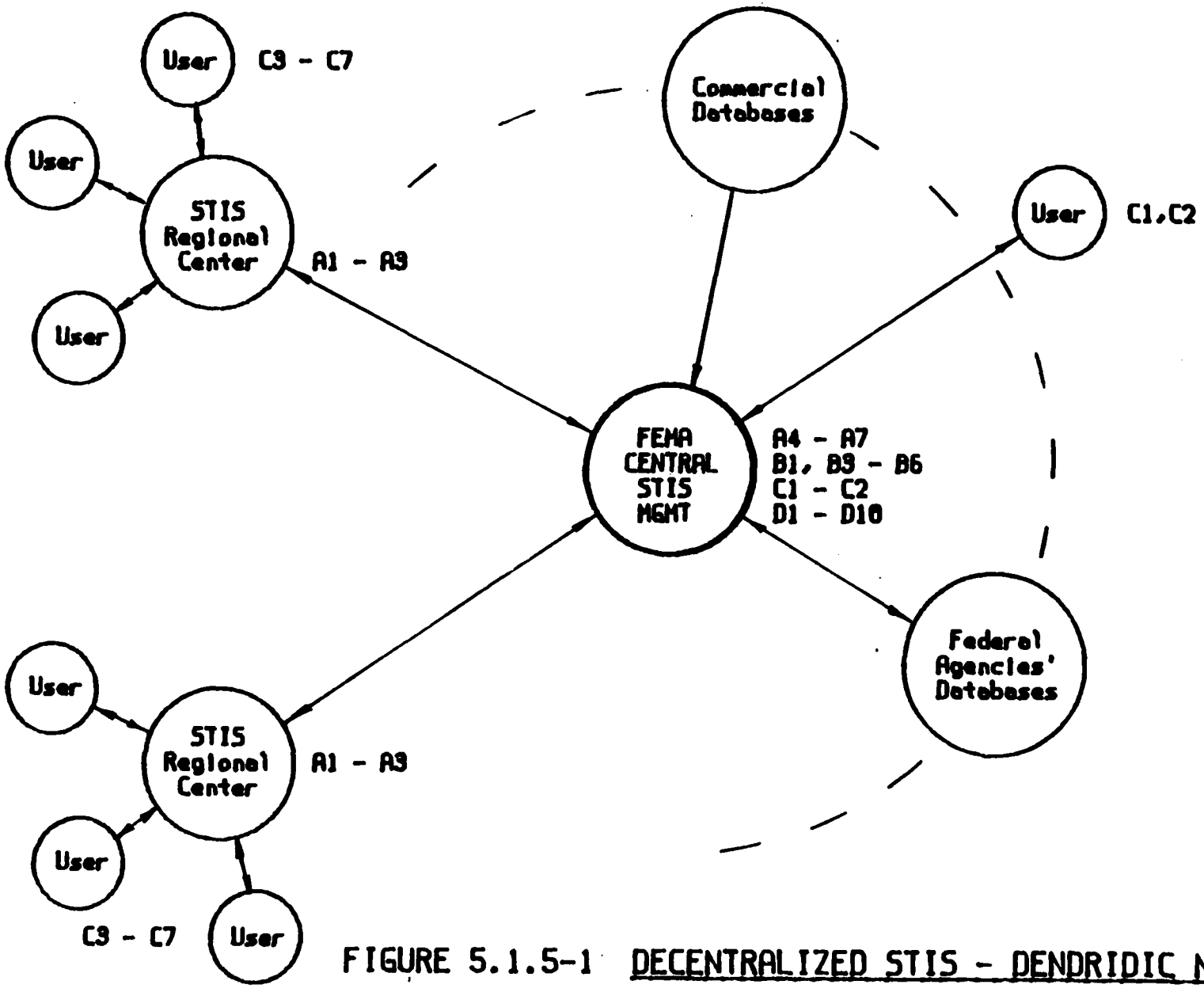

FIGURE 5.1.5-1 DECENTRALIZED STIS - DENDRIDIC NETWORK

Processes Manual Preparation

As in the centralized clearinghouse, a process control manual will be developed and continuously updated to provide guidance to the large staff on all the approved process of the STIS.

Material Screening and Processing Procedures

The database, fugitive file structure, and library will be developed and maintained using the procedures and processes suggested in the centralized clearinghouse configuration.

STIS Generated Products

Similiar to the centralized clearinghouse, this STIS option would develop informational materials, directories, and reports which could directly benefit a large segment of the targeted users of the clearinghouse and its satellites. These include a newsletter, electronic mail bulletins, source directories, and topical bibliographic reports.

Product Distribution and Dissemination Services

The product distribution, dissemination, and inventory control processes described for the centralized clearinghouse configuration will also be used in this STIS model. Records will additionally be kept of the distribution of materials requested by each of the satellite information centers to draw a profile of the regional centers' use of available clearinghouse services.

5.1.5.2 STIS Clients

As a total system, this STIS model would provide all the client services previously enumerated in the central clearinghouse description. However, this model would discourage the use of the core facility (located at FEMA)

by all potential users except local FEMA and other Washington based Federal agency personnel so that use of the regional information centers is encouraged. This policy would extend to the provision of materials. A request for reports, directories, etc. from a regional user would have to be forwarded to the decentralized clearinghouse (acting as a resource center) by the satellite information center.

5.1.5.3 Staff and Staff Support

The difference in staff requirements between this STIS option and the centralized clearinghouse STIS model are in the number of personnel involved in (a) the coordination process and (b) client interface. A listing of the personnel follows with descriptions of tasks added only where they are different from the task descriptions of Section 5.1.4.3.

- An administration staff consisting of the clearinghouse director, a secretary, and a clerk/typist.
- Two senior professionals - one with a scientific engineering background to develop the interagency relationships and interchanges described in Section 5.1.4.3; the other with a background in training, experience in library science, and some knowledge of computer technology. The role of the latter staff member would be to (a) prepare a course of instruction for personnel of newly organized regional information centers, (b) provide on-site technical assistance to newly organized regional information centers, and (c) periodically visit the regional information centers to monitor the effectiveness of interaction between the central system and the satellites and to update the region centers' personnel on modifications in the system.
- A system analyst/programmer responsible for system hardware and software requirements.
- A senior librarian responsible for organizing and maintaining the holdings of the central system.
- Two junior librarians and two clerk/typists who process all database, fugitive files, books, and materials entering the central system.

- o One researcher (rather than four researchers as in the centralized clearinghouse model) to provide interactive assistance to FEMA and Federal agency personnel (in the Washington area) using the core clearinghouse facilities. While this appears to be a budgetary saving, it may not be if the funding for the regional center personnel is a FEMA burden and is charged to the same budget center as the core clearinghouse of this STIS model. Decentralization, assuming a cadre of two junior librarians at each center, may require budgeting for 10 to 20 additional personnel to provide user interactive assistance.

- o Two researchers/editors who are responsible for developing and editing the internal products of the clearinghouse.

- o A staff person and an assistant responsible for packaging, distribution, dissemination, inventory control, etc.

In summary, this STIS option would require a staff of 16 full-time people (11 professionals and 5 support people) in the core clearinghouse (at FEMA in Washington) and a cadre of 10 to 20 people in the regional centers.

5.1.5.4 Required Facilities and Equipment

The facilities and equipment compliment of this STIS option would include the requirements of (a) the core facility (at FEMA headquarters in Washington) and (b) each of the regional centers. In the main, the core space requirements would be similiar to those described for the central clearinghouse (Section 5.1.4.4).

- o Approximately 1,500 square feet for offices and working space for the 16 full-time staff members.

- o Approximately 600 square feet for a library/conference area.

- o Approximately 150 square feet for a computer facility area.

- o Approximately 150 square feet for a reproduction area.
- o Approximately 400 square feet for storage, receiving, and shipping.

The equipment requirements would also approximate those of the centralized clearinghouse STIS model with the addition of individual modems (1200 BPS) for each interconnection between a regional information center (or other facility) and the core clearinghouse. The equipment needs in the core facility would be:

- o A minicomputer or FEMA mainframe linkage utilizing a multiplexer/controller and a high speed (9600 BPS) modem to connect the terminals within the core facility to the FEMA mainframe computer.
- o Two intelligent terminals and three terminals for staff purposes (database entry, word processing, text editing, etc.).
- o Medium speed (1200 BPS) modems for each interface with an outside facility (regional centers) if the minicomputer is used. If the FEMA mainframe is used, interfacing equipment would have to be provided at the FEMA mainframe location.
- o A high volume, high speed paper copier.
- o The furniture, files, and shelving requirements previously described for offices, a library, and a shipping area.

The regional centers would be generic in concept. They would have modest space and equipment requirements. Space allocation, office furniture needs, and electronic equipment would be similiar to the STIS model using a microcomputer (Section 5.1.3.4). An office area of approximately 400 square feet would provide office space for two staff and two visitors. The

computer and peripherals would be also similiar to the STIS option that utilizes a model using a stand-alone microcomputer. It is proposed that the regional center's computer include a 16-bit CPU microcomputer with an internal memory of 256 Kilobytes, a dot-matrix printer, and a medium speed modem (1200 BPS).

5.1.5.5 Where in FEMA?

Similar to the centralized clearinghouse model, the size and importance of this STIS suggests that it would function better if had the status of an office within FEMA which reports directly to the FEMA Director or as an office within either the Resource Management and Administration Directorate or OP-IR.

5.1.5.6 Start-up and Continuing Budget

It is assumed that FEMA headquarters will have to subsidize the regional center offices, salaries, and expenses. To enable some estimates of costs, it is further assumed that five regional centers would be set up and each would be staffed by the equivalant of two junior librarians (approximate annual salary - $19,000 each). Given this scenario and not considering major capital equipment costs (not chargeable to a FEMA office budget), the chargeable budget items would include:

- Staff salary - The core clearinghouse group (in Washington) would have a staff complement of 16 people. The five regional centers would have an additional 10 staff members. It is estimated that the annual payroll for this staff would approximate $590,000.

- Cost of material reproduction and dissemination - Similiar to the centralized clearinghouse, this STIS model will have to be recognized as a source that provides documents (directories, reproduced journal articles, newsletters, reproduced fugitive file materials, FEMA published and unpublished reports, etc.). It is estimated that a budget of $30,000 would be required annually to provide this service.

- Material procurement - As discussed in Section 5.1.2.6 start up of the library collection is estimated at $7,500 (procurement of 200 books); the continuing annual budget to increase the library holdings is estimated to be $2,000.

- Travel expense - Similiar to the rationale of Section 5.1.1.6 the travel budget to (a) coordinate the clearinghouse activities with the other information centers and libraries and (b) initiate cooperative agreements is estimated as an initial first year expense of $12,000 and a yearly follow-up expense of $5,000. To this will have to be added the travel budget for the trainer who must make periodic rounds of all the regional centers. Travel expense for the trainer is estimated as a first year expense of $10,000 and a yearly follow-up expense of $5,000.

In estimating the schedule of the budget, it is assumed that only the core component and two regional centers of this STIS model could be organized and made operational in the first year. Thus, the start-up budget is estimated at $438,000; the follow-up budget is estimated to be $632,000.

5.1.5.7 Level of Response to Program Objectives 2 -4

The subjective ratings of response of this STIS model to the objectives posed in Section 5.0 are as follows:

- Access and interchange of information bases among FEMA controlled and supported information elements. A rating of 10 is given because of the intended coordination and interchange process put in place to achieve this objective.

- Include assets which exists outside of FEMA. As in the centralized clearinghouse, it is intented that this STIS model collect all books, reports, materials, etc. on scientific and emergency management within the core clearinghouse of the system so that it can be a central repository and referral center of such materials. This STIS is rated a 10 on this objective.

- Implement a rapid response interactive system. Though the core clearinghouse of this STIS model will have total user response capability, the regional center resources will be more limited. The users of the regional centers may receive

slower response and more referrals to other centers. On the other hand, the regional centers will, most likely, broaden the base of users. This STIS model is rated an 8 on this objective.

5.1.6 Decentralized STIS - Coordinated Network

Figure 5.1.6-1 suggests an STIS option which centralizes the coordination function to achieve an integrated hazards and emergency management information network but decentralizes the FEMA position of being the central depository of information on the subject. The rationale for this concept includes the following factors:

- It is recognized by all Federal agencies, state, and local governments that the main purpose of FEMA is to coordinate interagency emergency planning and operational activities. This STIS model assumes that, therefore, there would be a general acceptance of FEMA's leadership in coordinating standards and processes to advance a scientific and technology information system which would improve the planning process.

- The survey of libraries (Section 4.2) that contain scientific and technical materials relevant to hazards and emergency management indicates that these holdings are so vast that it would be very expensive for FEMA to duplicate in a central facility. It would seem to be more realistic to advertise the resources of each facility and make them readily available to all users. Both desires may be served if a common interactive computer network were available to permit query and response of any library database by any other library (or information center) in the network.

- Several of the facilities visited to obtain needs assessment data (Section 4.1) suggested the need for coordination between the multiple libraries (public sector and universities) collecting scientific and technical information in hazards and emergency management as a means of informing each other of their holdings.

- The thrust of technology is for libraries to inventory their holdings and improve their retrieval capabilities through computer usage. While most of the facilities visited in the needs assessment study do not presently have funding or the

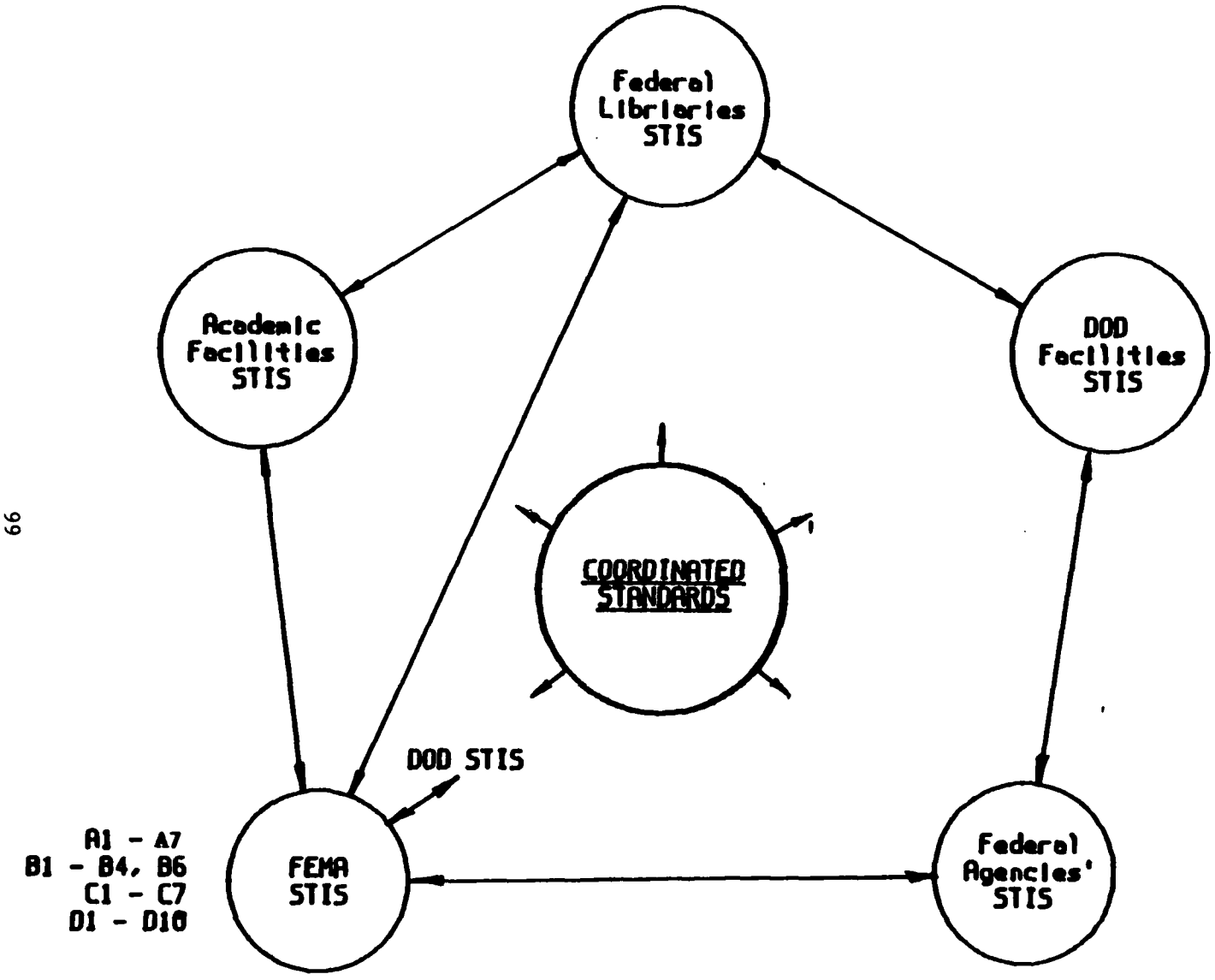

FIGURE 5.1.6-1 DECENTRALIZED STIS - COORDINATED NETWORK

ability to organize their own system, they are aware of their shortcomings and will, in time, correct them. Without coordination, each will approach their problem independently. The use of different software, lexicography, etc. would mitigate the libraries' (and information centers') ability to communicate with each other efficiently and would make the job of standardizing the information systems more difficult at a later time.

- The thrust of computer technology is at the point where, through the use of a Unix (ATT developed) operating system, operating portability between very different computers (8-bit, 16-bit, 32-bit) using assembly language is becoming a reality. This is important to this STIS concept because in order to achieve high file search speeds, assembly language would have to be used to program the search routines. What the Unix system accomplishes, beyond other portable operating systems (CP/M, MS/DOS, etc.), is independence from assembly language. As an operating system, Unix is independent of computer design, word size, or system architecture. Being independent of the assembly code of a specific microprocessor, it would satisfy this STIS model's purpose of standardization of operating software within different hardware configurations. It is also becoming readily available - minicomputers of many manufacturers have incorporated software (C Language) to utilize it. Microcomputers are being upgraded to use it.

- Advancements are also being made in (a) the development of digital telecommunications equipment and (b) the organization of protocols for computer network use. Large scale integrated microprocesseor techniques are advancing the state of the art in telephone equipment such as voice-data private branch exchanges (PBX) which applies to the network requirements of this STIS model. Protocols for network control management, data link control, and equipment control have been developed by several organizations (System Network Architecture (SNA) by IBM, DECNET by DEC, ARPNET by DOD, etc.). National and international standards groups are working to achieve compatability among all systems.

- Thus the timing, from a computer and telecommunications technological viewpoint, is proper to effectively, and most economically, standardize on a national information network system.

Differing from the centralized clearinghouse STIS (Section 5.1.4) or the decentralized clearinghouse with branching networks (Section 5.1.5),

this STIS option would recognize the desire of each Federal agency to build and maintain a library/information system covering their area of mandated responsibilities, and would appreciate that a major part of these holdings may include scientific and technological information of significance to hazards and emergency issues. This STIS option would center its design on how such information, though contained at different facilities, can be made readily available to all potential users without unnecessary duplication of database development and redundancy in user service.

The design illustrated in Figure 5.1.6-1 would assume that:

- Each node of the cooperating network would have a computerized database of scientific and technological information germane to specific areas of expertise.
- FEMA, being one of the nodes, would also have areas of expertise assigned to it. Areas which involve national security emergency planning (industrial mobilization planning, industrial protection, etc.) would probably make good candidates because of their limited coverage by other libraries (see Table 4.2-2 - Sample of Libraries That Have Emergency Related Materials).
- Each node of the system would be fully interconnected by telecommunications so that the database of each is availabel on-line and interactively.
- Each would provide reproduced hard copy of reports within their holdings on an as-needed basis to any other consortium member in the network. This would be done to eliminate the need for any agency's library to amass redundant collections of reports in order to service users within their agency.
- Standardization or compatibility of hardware, software, and telecommunications would be necessary to effect the network. Standardization of (a) key word terminology for index usage, (b) methods of preparing citations, and (c) menus and screens would be necessary to establish similiar user-friendly usage throughout the system and permit interaction between any two nodes in the system without special protocol.

- o FEMA would take the central role in organizing the standardization process for the network. FEMA would (a) chair a committee of agencies to achieve this standardization, (b) set the agenda and schedule of coordinating meetings, (c) work closely with task groups defining details of such a system, (d) provide major resources to develop a common lexicon, and (e) support the effort to "sell" the coordinated information system concept to Federal agencies' administrators by preparing detailed plans, cost analyses, and non-technical reports of the concept and its benefits to all cooperating agencies.

5.1.6.1 STIS Tasks

The theme of this STIS option emphasizes the FEMA coordinating role in developing an informational network while it de-emphasizes its position as a central clearinghouse of such information. This STIS model has the effect of spreading the tasks of the central clearinghouse to component clearinghouses where experts in different aspects of hazards and emergency management reside. Thus, each of the nodes of the network would be an integral clearinghouse (controlled and supported by different Federal agencies or external clearinghouses) and would encompass different areas of specialization within the hazards and emergency management disciplines.

While the level of material handling may be reduced for each node of the network when compared with the centralized clearinghouse (Section 5.1.4), the internal processes of (a) material and data collection, (b) system processing to create the database, vertical files, library holdings, etc., (c) development of clearinghouse products such as the electronic mail bulletins, source directories, topical bibliographic collections, etc., (d) user service, and (e) distribution and dissemination methods would be similar for each of the elemental clearinghouses of the system. Users of the system may be able to enter and be equally served by any node of the network.

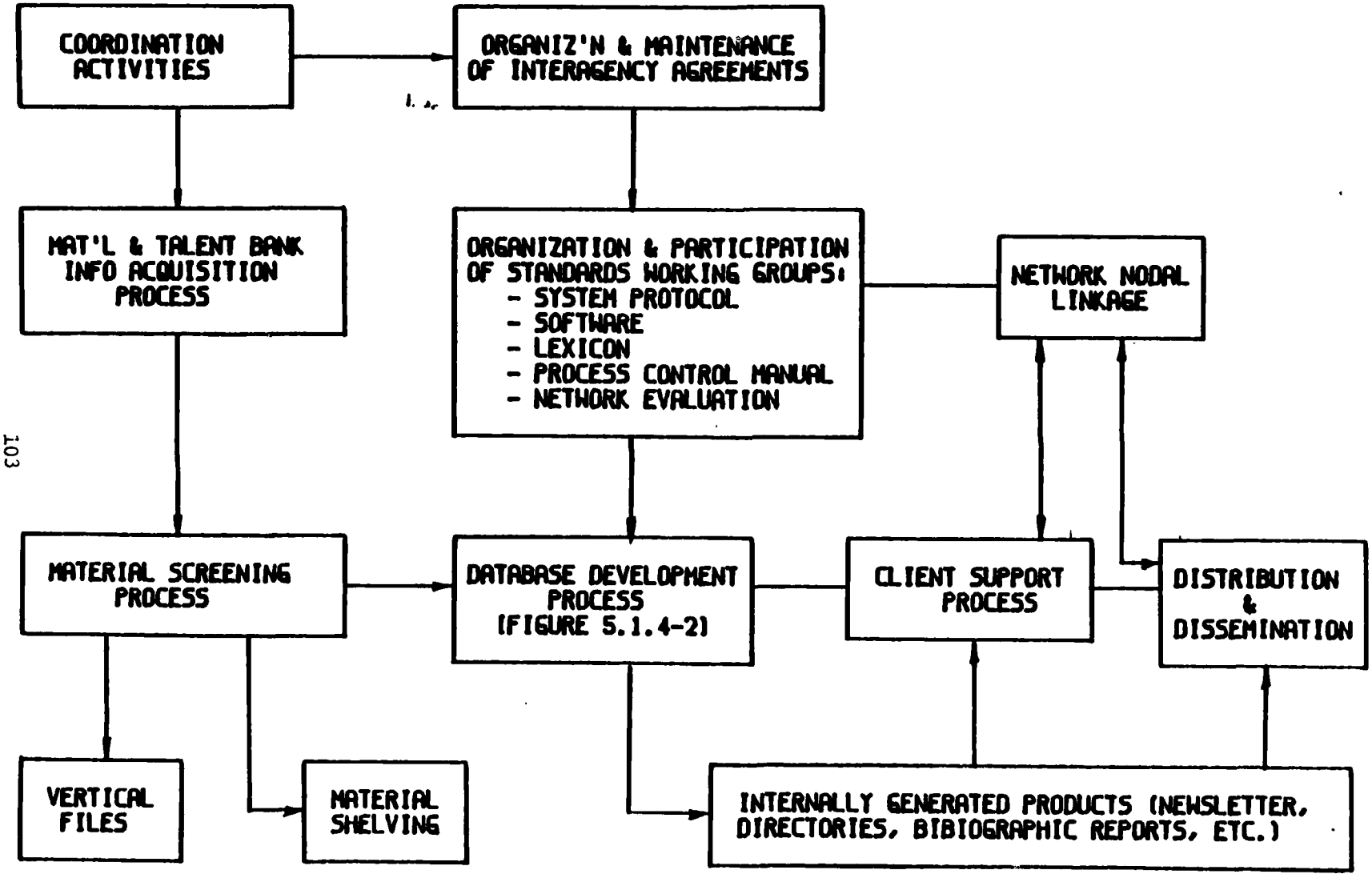

FIGURE 5.1.6-2 DECENTRALIZED STIS - COORDINATED NETWORK ACTIVITIES

As a way of illustrating the tasks of a component of the network, the tasks within the FEMA node of the network are shown in Figure 5.1.6-2 and described by the following categories.

Coordination Activities

In the previous STIS models, the primary coordination activities were focused on (a) determining the holdings of external libraries and information centers in order to reach collective agreements for sharing databases and materials and (b) finding talent bank resource information from Federal agencies, academic sources, professional associations, etc. Their primary role was to serve as a method for obtaining the database for the STIS options. In the decentralized STIS model with branching regional centers (Section 5.1.5), it went one step forward in including a training component.

In this STIS option, the coordination tasks are more central to the entire concept. In fact, the concept cannot be mechanized with the required coordination tasks. As indicated in Figure 5.1.6-2, FEMA would serve as the catalyst to standardize all database development and information dissemination processes and procedures used in the system. It would:

- Chair a committee which allocates the informational responsibilities of each of the component clearinghouses of the network.
- Participate in the process of defining the hardware and software standards to be used by the system. These standards would include the development of common methods for (a) abstracting documents and summarizing talent bank information, (b) generating data fields and contents, and (c) organizing menus, screens, and other user-friendly tools for computer usage so networking between any two nodes of the system would be similiar and not require additional knowledge or protocol procedures.

- o Participate in the process of developing a common lexicon for index-usage so that on-line searches of different databases can be made using common directories.

- o Participate in the process of developing standard methods for organizing and detailing source directories and topical bibliographic reports.

- o Participate in the process of developing a common process control document. FEMA would assume responsibility for maintaining the document and distributing it to all elements of the network. All updates would be reviewed and approved by the working group.

- o Participate in the process of organizing a committee to develop a review process to periodically review the activities, accomplishments, and problem areas of individual components of the system as well as the operation of the entire network. A rotating panel of members from among the staff would serve on the evaluation committee. The findings of the evaluation would be used to improve on-going activities and change the process control document.

- o Organize a methodology to receive newsworthy information from the components of the network in order to publish a central newsletter. As coordinator, FEMA would be responsible for publication of a newsletter whose purpose is to advertise the services of all the components of the network.

Material Screening and Processing Procedures

As indicated in Figure 5.1.6-2, the database, fugitive file structure, and library of the FEMA component of the network would be developed using procedures and processes similar to those suggested for the centralized clearinghouse configuration (Section 5.1.4.3). The subject of FEMA facilities' material screening and process would, as in other components of the network, be limited to one discipline.

STIS Generated Products

Similiar to the centralized clearinghouse, this STIS option would develop and distribute informational materials, directories, and reports.

Differing from the centralized clearinghouse model, all but one of these products would be specific to the emergency management discipline. The only exception is in the production of a newsletter. In this STIS concept, FEMA would prepare, edit, monitor and print, process, and distribute a newsletter which would cover the activities of the entire network. On the other hand, FEMA (being a component of the network) would prepare electronic mail bulletins, source directories, topical bibliographic reports, and research reports only on subjects within the area of expertise assigned to its clearinghouse.

Client Support Services

As shown in Figure 5.1.6-2, this STIS model would provide client support activities ranging from (a) on-line searches of its internal database, the databases of the other specialty clearinghouses within the network, as well as other available databases, (b) provision of copies of reports and data available within its fugitive files and requests for copies of reports and data available within the fugitive files of the specialty clearinghouses in the network, (c) research, analysis, and reports on topics of special interest which require investigation of all available internal and external (network) database and files. As discussed in Section 5.1.4.1.5, the development of special reports would require the approval of a selection board.

As in the centralized clearinghouse, a process of internal evaluation of response to client needs and perceived utility would be conducted by utilizing a client follow-up and feedback questionnaire to measure effectiveness from the client's perspective.

Product Distribution and Dissemination Services

The product distribution, dissemination, and inventory control processes described for the centralized clearinghouse configuration will also be used in this STIS model. Records will additionally be kept of the distribution of materials requested by each of the specialized clearinghouses in the network to evaluate the use of the FEMA specialty clearinghouse by the other nodes of the network. Evaluation of the utility factor for each of the specialty clearinghouses of the network would serve as a measure of interagency cooperative involvement.

5.1.6.2 STIS Clients

The FEMA specialized clearinghouse in this STIS model will have available from its own database and holdings, or will have access from the network and its holdings, an equal or greater amount of scientific and technical information on hazards and emergency management when compared with the centralized clearinghouse model. Because of the architecture of this STIS concept, this statement can be made from the vantage point of each of the nodes of the network. The clients of the system would therefore use the closest or most convenient specialized clearinghouse to obtain support. As conceived, any of the clearinghouses would be available to serve a client. In reality, FEMA personnel would probably use the FEMA component of the network, personnel of other Federal agencies would probably use a component of the system associated with their agency; state and local government administrators and planners, researchers, graduate students, and the general public would probably use the network component of the Federal agency with which they are most familiar.

5.1.6.3 Staff and Staff Support

It is assumed in this STIS model that each agency would structure and fund their own component of the network. Therefore the staff under discussion is the one associated with the FEMA node of the network. As compared with the centralized clearinghouse, the staff requirements of this STIS option would be altered to reflect the difference in client interface and in the coordination process. It would require less user-support personnel because it would service a smaller number of clients. It would require an additional senior level professional to assist in the coordination process leading to standardization of the network. A listing of the personnel follows with the descriptions of tasks added only where they are different from the task descriptions of Section 5.1.4.3.

- An administration staff consisting of the FEMA specialized clearinghouse director, a secretary, and a clerk/typist.
- Two senior professionals to perform the coordination tasks. One to develop the interagency relationships and interchanges described in Section 5.1.4.3; the other to organize and participate in committees and working groups on standards (Section 5.1.6.1) for the network.
- A system analyst/programmer responsible for internal system hardware and software requirements. This system analyst/programmer would also participate as a member of the working group concerned with standardizing computer hardware and software within the network.
- A senior librarian responsible for organizing and maintaining the holdings of the central system.
- Two junior librarians and two clerk/typists who would process all database, fugitive files, books, and materials entering the central system.

- o Two researchers rather than four researchers (as in the centralized clearinghouse model) to provide interactive assistance to FEMA personnel, state and local government personnel, researchers, and any other clients wishing to use this node of the network.

- o One researcher/editor who is responsible for developing and editing the internal products of the clearinghouse.

- o A staff person and an assistant responsible for packaging, distribution and dissemination, inventory control, etc.

In summary, this STIS option would require a staff of 16 full-time people (11 professionals and 5 support people) within the FEMA component of the network. This STIS model assumes that the other participating agencies would organize a facility and staff it with equivalent personnel.

5.1.6.4 Required Facilities and Equipment

The facilities and equipment compliment of this STIS option within FEMA, and presumably at other nodes of the network, would be similiar to those described for the central clearinghouse (Section 5.1.4.4).

- o Approximately 1,500 square feet for offices and working space for the 16 full time staff members

- o Approximately 600 square feet for a library/conference area.

- o Approximately 150 square feet for a computer facility area.

- o Approximately 150 square feet for a reproduction area.

- o Approximately 400 square feet for storage, receiving, and shipping.

The equipment requirements would also approximate those of the centralized clearinghouse STIS model with the addition of telecommunication equipment to permit multiple and simultaneous interaction between the FEMA specialized

clearinghouse and other nodes of the network. The equipment needs for a component of the network such as FEMA would be:

- o A minicomputer or a FEMA mainframe linkage utilizing a multiplexer/controller and a high speed modem (9600 BPS) to connect the terminals within the core facility to the FEMA mainframe computer.
- o Two intelligent terminals and three terminals for staff purposes (database entry, word processing, text editing, etc.).
- o PBX equipment at the FEMA specialized clearinghouse facility to interconnect telephones, terminals, and the minicomputer within the FEMA facility to the equipment of the other nodes in the network. If the FEMA mainframe is used, the PBX would have to interconnect the other nodes of the network to the telephones and terminals in the FEMA clearinghouse facility as well as the computer at the FEMA mainframe facility. Some interfacing equipment may have to be provided at the FEMA mainframe location to permit this interconnection.
- o A high volume, high speed paper copier.
- o The furniture, files, and shelving requirements previously described (Section 5.1.4.4) for offices, a library, and a shipping area.

5.1.6.5 Where in FEMA?

The size and importance of this STIS suggests that it would function better if had the status of an office within FEMA which reports directly to the FEMA Director or because of the extensive coordination needs with the Training and Education Directorate.

5.1.6.6 Start-up and Continuing Budget

In considering the budget requirements, it is assumed that each agency will subsidize their own component of the network. FEMA will, however, contribute more than other agencies in the coordination process. Given this scenario and not considering major items of capital equipment costs

such as the minicomputer, computer peripherals, telecommunication equipment — the FEMA budget (outside of capital equipment) would include:

- Staff salary. The FEMA specialized clearinghouse would have a staff complement of 16 people. It is estimated that the annual payroll for this staff would approximate $400,000.

- Cost of material reproduction and dissemination. Similiar to the centralized clearinghouse, this STIS model will have to be recognized as a source that provides documents (directories, reproduced journal articles, newsletters, reproduced fugitive file materials, FEMA published and unpublished reports, etc.). It is estimated that a budget of $30,000 would be required annually to provide this service.

- Material procurement. As discussed in Section 5.1.2.6, an estimated $7,500 is needed to start up the library collection (procurement of 200 books); the continuing annual budget to increase the library holdings is estimated to be $2,000.

- Travel expense. Similiar to the rationale of Section 5.1.1.6, the travel budget to (a) coordinate the clearinghouse activities with the other information centers and libraries and (b) initiate cooperative agreements is estimated as an initial first year expense of $12,000 and a yearly follow-up expense of $5,000. To this will have to be added the travel budget for the staff involved with committees and work groups to standardize the software programs, menus and screens, operational processes, etc. of the STIS network. Travel expenses for this coordination activity is estimated as a first year expense of $10,000 and a yearly follow-up expense of $5,000.

The start-up budget of the FEMA component of network (not including capital equipment) is estimated at $460,000; the annual follow-up budget is estimated to be $440,000.

5.1.6.7 Level of Response to Program Objectives 2 - 4

The subjective ratings of this STIS model to the objectives posed in Section 5.0 are as follows:

- Access and interchange of information bases among FEMA controlled and supported information elements. A rating of 10 is given because of the intended coordination and interchange process put in place to achieve this objective.

- Include assets which exist outside of FEMA. It is believed that this STIS concept would be the most effective option for making use of outside databases and material assets. The linkage of the elements of the network and the commonality in software and process between the components of the software would simpify the ability to use these external resources. This STIS is rated a 10 on this objective.

- Implement a rapid response interactive system. The architecture of this network would permit on-line interactive use of the databases of all the specialized clearinghouses of the system giving a STIS user the broadest possible scientific and technical baseline on hazards and emergency management information. This STIS model is rated a 10 on this objective.

DESIGN OF A

SCIENTIFIC INFORMATION COLLATION AND DISSEMINATION SYSTEM

SECTION III

CONCLUSIONS AND RECOMMENDATIONS

6.0 CONCLUSIONS AND RECOMMENDATIONS

This portion of the report provides a series of conclusions and recommendations to assist FEMA in establishing an STIS. They are distilled from the entire report.

Three external components were significant in determining the STIS configurations discussed in section 5.0.

1. A needs assessment study detailing the perceptions of potential STIS users and professionals who manage information centers or specialized libraries (see section 4.1 and Appendix B).

2. A survey of libraries that contain information and materials of significance in emergency management and related fields (see section 4.2 and Appendix B).

3. A survey to determine the size of a talent bank (see section 4.3).

In addition to the direction that these three study components provided each one of the six STIS configurations have inherent structural strengths and weaknesses. All of the above provide a basis for the following conclusions and recommendations.

6.1 CONCLUSIONS

The following section summarizes the project's findings.

1. There is a near unanimous felt need and urgency among those interviewed for the establishment of an STIS.

2. There is a high level of consensus among those interviewed that FEMA must take a lead coordinative role in the establishment of an STIS.

3. The breadth and complexity of emergency management and the related emergency management fields makes an information system designed as a coordinative network essential.

4. The specialized libraries visited are amenable to a coordinative STIS. The holdings of the FEMA libraries, NBS Center for Fire Research, Disaster Research Center, Center for Technology Environment and Development and the Natural Hazards Research and Applications Information Center could provide the core nodes of an STIS.

5. Time is of the essence. Unless FEMA moves quickly its preeminent role as a potential coordinator of an STIS will vanish and other organizations such as the specialized libraries (CENTED, NHRAIC) or other federal agencies (EPA, DOT) will either seize the initiative or head in their own direction making a latter coordination effort very difficult.

6. The complexity of FEMA's many roles and missions and its intricate and delicate relationships with other federal agencies and departments makes an STIS an imperative if FEMA is to gain control and direction of its own research and development efforts.

7. FEMA is currently unable to respond effectively to a large number of emergency management inquiries it receives. This situation can only worsen as FEMA's Integrated Emergency Management System becomes fully operational and as FEMA continues to successfully expand the interest in emergency management to other professional groups (e.g., public administration community).

8. An internal FEMA "champion" must be found for the STIS. He/she must be fully supported by the highest levels of FEMA management. Only with high level support can an STIS become fully operational within the very diversified FEMA directorates.

9. The Federal Laboratory Consortium for Technology Transfer must be considered an important element in any STIS.

10. Presuming a coordinative network is established, the expert resource file (talent bank) of the STIS should be structured as a dual system, with (1) a listing of particular areas of major concern in which a half dozen experts would be identified and (2) a series of access pathways via the various nodes of the STIS that would identify other skills and have access to the broader categories.

6.2 RECOMMENDATIONS

The final section discusses the project's recommendations. These recommendations are based on the study's conclusions and the other findings summarized in the report.

Recommendation 1 - FEMA should immediately initiate the development of a Scientific and Technical Information System (STIS) via a simultaneous two track implementation process. The objective of the first track would be the establishment of an automated referral and library service through the organization framework of the FEMA libraries (see system design options 2 and 3 in section 5.0). Simultaneously, the second track would have as its objective the establishment of a consortium for the development of a decentralized STIS - coordinated network (see system design option 6 in section 5.0).

Recommendation 2 - The establishment of an automated referral and library service should proceed and be linked under the longer term umbrella objective of establishing a decentralized STIS - coordinated network.

The FEMA automated referral and library service should have two centers (and thus FEMA would have two nodes within the consortium's coordinated network). The first should be established at FEMA's Information Resource Management Library, the second, a satellite of the first, at FEMA's NETC Learning Resource Center.

The two centers would differ (as with the other nodes or members of the consortium) by their areas of expertise. The NETC Learning Resource Center should continue to specialize in the practical application questions related to fire department operations, hazardous materials, code administration and enforcement, etc. The Information Resource Management Library should begin specializing in the more highly technical and research oriented domestic and national security emergency fields such as industrial protection, etc.

The two FEMA centers would also differ in their level of service. To avoid duplication and to foster the development of strong linkages and communication between the centers the NETC Learning Resource Center would be dependent upon the clearinghouse functions of the Information Resources Management Library.

Recommendation 3 - The number of organizations invited to participate in the coordinated network should initially remain small to actuate the agreement process and the formal establishment of the consortium. It is recommended that the core members of the network should include the following organizations:

- The National Bureau of Standards Center for Fire Research;

- The Disaster Research Center (shortly to be housed at the University of Delaware);
- The Center for Technology, Environment and Development, Clark University;
- The Natural Hazards Research and Applications Information Center, University of Colorado; and,
- The two FEMA resource Centers.

These core members have the ability to cover in general the wide spectrum of subject areas in emergency management. Upon the establishment of the consortium, FEMA, as chair organization, can use the strength of the consortium to induce other federal agencies to participate, e.g. EPA, DOT, USGA.

Recommendation 4 - *Upon the establishment of the consortium,* FEMA should take the central role in organizing the standardization process for the coordinated network. FEMA should (a) chair the standardization committee, (b) set the agenda and schedule of coordinating meetings (c) work closely with task groups defining details of the system (d) provide resources to develop a common lexicon (e) provide funding for automating the resources in the smaller, highly specialized libraries of the consortium (f) prepare detailed plans, cost analyses, and non-technical reports of the network concept and its benefits to promote it to other federal agencies and libraries.

Recommendation 5 - The management of an expert talent resource file should be central to the functioning of the coordinated STIS and should operate on a two-tiered basis, one formal and one informal. The formal tier should be automated (see section 4.3)

and consist of a small number (under 1,000) of key specialists and transfer agents. For example, each one of the approximately 90 subject specialists that work for the NBS Center for Fire Research should be included in the formal tier of the talent bank. The cadre of experts that are known by these specialists in their various fields would be considered a part of the informal network. Currently, each one of the recommended core organizations of the proposed consortium uses an informal expert referral system. The Natural Hazards Research and Applications Information Center, for example, uses the list of invitees to the annual Natural Hazards Research Workshop. These persons are personally known by the Center's staff and have a wide access to others in the field.

Recommendation 6 - The formal tier of the expert file should remain highly exclusive. Only those persons professionally known by the organizations in the network as individuals with a high level of expertise or information transfer agents who have a particularly wide array of professional contacts in the relevant fields should be included. This standard of excellence will help persuade expert talent to participate. The expert file should be voluntary and be developed through the informal systems currently employed by the potential network organizations. Formal standards for acceptance into the file should be established by the core network members upon the establishment of the consortium. Finally, any financial arrangements to obtain the services of these experts or the cadre of others informally referred would be the responsibility of the user.

DESIGN OF A

SCIENTIFIC INFORMATION COLLATION AND

DISSEMINATION SYSTEM

FINAL TECHNICAL REPORT

VOLUME III

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PREFACE

This project was administered by the Academy for State and Local Government which is directed by Enid Beaumont. The project was conducted under the direction of Gerard J. Hoetmer, Principal Staff Associate and Director of Public Safety Programs, with the International City Management Association. Morris J. Taubenslag, President, TASCQ Services, Inc. provided technical consulting. The research and the final technical report were supported by the Federal Emergency Management Agency under Contract No. EMW-C-0877.

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DESIGN OF A

SCIENTIFIC INFORMATION COLLATION AND DISSEMINATION SYSTEM

APPENDIX A

APPRAISAL OF OPTIONS

COST/SERVICE CONCEPTS

The purpose of this appendix is to suggest a measure of appraisal of the scientific and technological information system options of Section 5.0 on the basis of a cost/service relationship. Such a measure is important because it provides a rationale for appraising the worth of an STIS model to FEMA. Given the need for funds by various projects within FEMA, such a cost/service relationship provides a baseline from which to measure not only the choice of an STIS option on the basis of the most effective expenditure of monies but also to compare the funding of an STIS to other projects of interest to FEMA.

The definition of "cost" in the cost/service equation is assumed to be the annual budgetary requirement of a FEMA group to maintain any one of the STIS options. This definition is assumed with the knowledge that capital equipment amortization costs, equipment maintenance costs, utility costs, and other indirect costs (which would be assumed by a for-profit organization) are not factored into the equation. The effect of not including these elements is that it biases the results of the cost/service in favor of the sophisticated systems that utilize minicomputers and complex telecommunications equipment. The justification for using the chosen "cost" definition is that it reflects the budgetary operation and concern of a FEMA directorate.

Section 5.0 included discussion of the annual budget requirements of each STIS model which follows the STIS start-up phase. A summary of the estimated annual budgetary requirements for each of the STIS models described in Section 5.0 follows:

- o Option 1 - Manually Operated Referral Service.....$ 86,000
- o Option 2 - Manual Referral and Library Service..... 118,000
- o Option 3 - Automated Stand-Alone STIS..... 128,000
- o Option 4 - Central System (Star Network)..... 467,000
- o Option 5 - Decentralized STIS (Dendritic Network)..... 632,000
- o Option 6 - Decentralized STIS (Coordinated Network).....440,000

The definition of "services" is made up of elements which are perceived to provide useful products and service to targeted clients. In this report Tables 3.1-1 to 3.1-4 indicated a format for rating:

- o Service to users
- o Emergency management information coordination
- o Class of users
- o Internal management

Additional services to be rated for each STIS model are elements which are intrinsic to FEMA operational philosophy. These include the implementation of an STIS model which (a) supports an Integrated Emergency Management System (IEMS) concept and (b) permits FEMA to take a primary role in coordinating interagency activities.

The tables that follow (Tables App-1 to App-4) enumerate the consensus ratings on the elements of Tables 3.1-1 to 3.1-4 by seven senior FEMA professionals who served on the project's advisory committee. The ratings are based on a scale of 0-10, with 0 being low and 10 being high.

TABLE APP-1 SERVICE TO USERS

Code	Service	Committee Rating
A.1	On-line search of published documents and reports	6.29
A.2	Referral to other databases and services	6.0
A.3	Provision of resource and talent information	7.86
A.4	Provision of period bulletins/newsletter	5.29
A.5	Provision of electronic mail	4.57
A.6	Provision of hardcopy/microfiche/magnetic tapes	7.0
A.7	Research of fugitive files and all databases to prepare a report on a specific subject of interest to a user of the STIS	5.86

A rank order of the ratings of Table App-1 indicates that the consensus of the FEMA professionals believe that the most useful service to users would be (a) resource and talent bank information and (b) provision of hard copies of materials. One of the prime objectives in the consideration of the STIS models - the implementation of an on-line interactive system - was rated third in importance. The ratings downgraded the relative importance of informational outreach mechanisms such as an STIS newsletter, informational bullentins, and electronic mail. The level of the downgraded ratings suggest that the respondents see the STIS model as a reactive, rather than proactive, mechanism.

TABLE APP-2 EMERGENCY MANAGEMENT INFORMATION COORDINATION

Code	Service	Committee Rating
B.1	Organize national guidelines for emergency management information methodology and exchange	7.71
B.2	Organize a universal lexicon for an emergency management reference system	8.29
B.3	Organize an emergency management information network with public sector and university facilities nodes	7.14
B.4	Organize an electronic mail network	5.14
B.5	Setup, train, and provide support for regional satellites of an STIS	4.71
B.6	Organize a process of informational exchange between Federal agencies and technical information centers	6.86

The respondents queried gave high ratings to coordinating activities which are features of the Decentralized STIS Coordinated Network model (Section 5.1.6) such as organizing a universal lexicon and organizing national guidelines for an emergency management information system. The lowest rating was given to the organization and support of a training program for regional satellites of an STIS model. This coordination function is essential to the Decentralized STIS - Dendritic Network (Section 5.1.5). The ratings suggest that the respondents believe FEMA's role should be that of managing integration processes between agencies and information centers rather than providing operational support to coordinate separate information centers within a network.

TABLE APP-3 CLASS OF USERS

Code	Class of User	Committee Rating
C.1	FEMA Personnel	8.71
C.2	Other Federal agencies' emergency management planners	7.86
C.3	Other Federal agencies' professional staff	6.57
C.4	State and local government emergency management planners and practitioners	7.71
C.5	State and local government officials	4.57
C.6	Researchers	7.0
C.7	Graduate students	5.29
C.8	The general public	5.0

A rank order of the ratings of Table App-3 indicates strong opinion that the targeted users should be those scientists and technicians who are involved in emergency management planning as a full time occupation. In rank order these include (a) FEMA personnel, (b) other Federal agencies' emergency management planners, (c) state and local government emergency management planners and practitioners, and (d) researchers (assumed to be involved in emergency management programs). Lowest rated (in reverse rank order) users, in the opinion of the respondents, should be (a) state and local government officials, (b) the general public, (c) graduate students, and (d) other Federal agencies' professional staff. As in the ranking of "service to users" (Table App-1), the level of the lower rated elements suggest opinions that the STIS model should not place equal emphasis on outreach (and service) to all potential users.

TABLE APP-4 INTERNAL MANAGEMENT

Code	Activities	Committee Rating
D.1	Collect talent bank information and maintain the file	7.86
D.2	Organize and keep an information exchange between other public sector agencies active	7.71
D.3	Collect materials (abstracts, reports, books)	7.71
D.4	Develop criteria for (a) entry to databases, (b) storage in fugitive files, (c) material elimination, etc.	7.86
D.5	Setup information retrieval system	6.43
D.6	Setup library of (a) hardcopies, (b) vertical file, (c) microfiche, etc.	6.71
D.7	Catalog, index and abstract D.4 materials	6.86
D.8	Process and edit D.7 materials	6.14
D.9	Setup and maintain material dissemination process	7.57
D.10	Organize and operate a self-evaluative system to dynamically improve the STIS	6.57

It was not surprising that (a) collecting and maintaining the talent bank information, (b) developing the criteria for material sorting, (c) organizing and maintaining an active information exchange process between other public sector agencies, and (d) collecting materials from these agencies were rated highly in Table App-4. It was surprising that the respondents gave a high rating, and therefore placed a high value, on the internal activity required to organize and maintain a material dissemination process. This feature is contained in the more sophisticated clearinghouse options (the Centralized System - Star Network, the Decentralized STIS - Dendritic Network, and the Decentralized STIS - Coordinated Network) of this study.

Table App-5 is a matrix which enumerates a multiplier factor value and a compliance rating for the "service" of each of the STIS models. The multiplier factor, within three grades, indicates each STIS model's level of responsiveness to the elements described in Tables App -1 to App-4 as well as the model's responsiveness to the IEMS concept. A value of 1 is given as a multiplier factor if that STIS model's level of response is considered adequate, 2 is given for a good level of response, and 3 is given for excellent response. Where there is no response to any of the elements of the tables or to the IEMS concept, a value of -1 is given.

The cells of the matrix which define the compliance ratings of the STIS models are titled "Resultant." The values of these cells are the product of the described multiplier factor and the ratings of the elements of Tables App-1 to App-4. To simplify understanding of Table App-5, these ratings are repeated in the table following the description of each system service.element.

The addition of the elements of the "Resultant" column of each STIS model yields a value which is assumed to be the "service factor" of the STIS model. This service factor provides a numerical value with which to compare the responses of the different STIS models to the system service elements of Table App-5. As can be anticipated, because STIS model 1 (Manual Mode - Referral Service), model 2 (Manual Mode - Referral Service and Library), and model 3 (Stand-Alone ADP) do not provide full user service, as would a clearinghouse, they have much lower service factor values than STIS models 4 - 6 which are configured as clearinghouses.

FIGURE APP-5 MATRIX OF MULTIPLIER AND SERVICE FACTOR PRODUCTS OF THE SIX STIS OPTIONS

SYSTEM SERVICE ELEMENTS	RATING	STIS OPTION 1 REFERRAL SRVC ONLY		STIS OPTION 2 REF'RAL SRVC & LIBR.		STIS OPTION 3 STAND-ALONE ADP		STIS OPTION 4 CENTRAL CLEARINGHSE		STIS OPTION 5 DENDRITIC NETWORK		STIS OPTION 6 COORDINATED NETWORK	
		MULT'PLR	RESULT'NT	MULT'PLR	RESULT'NT	MULT'PLR	RESULT'NT	MULT'PLR	RESULT'NT	MULT'PLR	RESULT'NT	MULT'PLR	RESULT'NT
A1 - On-line search srvc	6.29	-1	-6.29	-1	-6.29	2	12.58	3	18.87	3	18.87	3	18.87
A2 - Referral service	6.0	1	6.0	2	12.0	1	6.0	3	18.0	3	18.0	3	18 0
A3 - Resource and talent information	7.86	2	15.6	2	15.6	2	15.6	3	23.58	3	23.58	3	23.58
A4 - Provision of period bulletins/newsletter	5.29	-1	-5.29	-1	-5.29	-1	-5.29	3	15.87	3	15.87	3	15.87
A5 - Provision of electronic mail	4.57	-1	-4.57	-1	-4.57	-1	-4.57	3	13.71	3	13.71	3	13.71
A6 - Provision of hardcopy, microfiche/mag tapes	7.0	-1	-7.0	-1	-7.0	-1	-7.0	3	21.0	3	21.0	3	21.0
A7 - Research reports	5.86	-1	-5.86	-1	-5.86	-1	-5.86	3	17.58	3	17.58	3	17.58
B1 - Organize national guidelines for information exchange	7.71	-1	-7.71	-1	-7.71	-1	-7.71	1	7.71	1	7.71	3	23.13
B2 - Organize lexicon for info ref. system	8.29	-1	-8.29	-1	-8.29	1	8.29	2	16.58	2	16.58	3	24.87
B3 - Organize information network	7.14	-1	-7.14	-1	-7.14	-1	-7.14	-1	-7.14	2	14.28	3	21.42
B4 - Organize electronic mail network	5.14	-1	-5.14	-1	-5.14	-1	-5.14	3	15.42	3	15.42	3	15.42
B5 - Set-up/train/support regional satellites	4.71	-1	-4.71	-1	-4.71	-1	-4.71	-1	-4.71	3	14.13	-1	-4.71
B6 - Organize information exchange between Fed. agencies	6.86	1	6.86	1	6.86	1	6.86	2	13.72	2	13.72	3	20.58
C1 - Use by FEMA Personnel	8.71	2	17.42	2	17.42	3	26.13	3	26.13	3	26.13	3	26.13
C2 - Use by other Fed emrgncy mgmt planners	7.86	1	7.86	1	7.86	2	15.72	3	23.58	3	23.58	3	23.58
C3 - Use by other Federal agencies' staff	6.57	1	6.57	1	7.71	-1	-6.57	3	19.71	3	19.71	3	19.71
C4 - Use by State & local govt emrgncy mgmt planners	7.71	-1	-7.71	-1	-7.71	-1	-7.71	3	23.13	3	23.13	3	23.13

(Continued)

FIGURE APP-5 MATRIX OFMULTIPLIER AND SERVICE FACTOR PRODUCTS OF THE SIX STIS OPTIONS (CON'T)

SYSTEM SERVICE ELEMENTS	RATING	STIS OPTION 1 REFERRAL SRVC ONLY		STIS OPTION 2 REF'RAL SRVC & LIBR.		STIS OPTION 3 STAND-ALONE ADP		STIS OPTION 4 CENTRAL CLEARINGHSE		STIS OPTION 5 DENDRITIC NETWORK		STIS OPTION 6 COORDINATED NETWORK	
		MULT'PLR	RESULT'NT	MULT'PLR	RESULT'NT	MULT'PLR	RESULT'NT	MULT'PLR	RESULT'NT	MULT'PLR	RESULT'NT	MULT'PLR	RESULT'NT
C5 - Use by state & local govmt officials	4.57	-1	-4.57	-1	-4.57	-1	-4.57	3	13.71	3	13.71	3	13.71
C6 - Use by researchers	7.0	-1	-7.0	-1	-7.0	-1	-7.0	3	21.0	3	21.0	3	21.0
C7 - Use by students	5.29	-1	-5.29	-1	-5.29	-1	-5.29	3	15.87	3	15.87	3	15.87
C8 - Use by the general public	5.0	-1	-5.0	-1	-5.0	-1	-5.0	3	15.0	3	15.0	3	15.0
D1 - Collect and maintain talent bank info	7.86	2	15.72	2	15.72	3	23.58	3	23.58	3	23.58	3	23.58
D2 - Maintain info exchange between public sector agencies	7.71	1	7.71	1	7.71	1	7.71	2	15.42	2	15.42	3	23.13
D3 - Collect Materials	7.71	-1	-7.71	2	15.42	-1	-7.71	3	23.13	3	23.13	2	15.42
D4 - Develop info processing & storage criteria	7.86	1	7.86	2	15.72	2	15.72	3	23.58	3	23.58	3	23.58
D5 - Setup info retrieval system	6.43	1	6.43	1	6.43	2	12.86	3	19.29	3	19.29	3	19.29
D6 - Setup library	6.71	-1	-6.71	2	13.42	-1	-6.71	3	20.13	3	20.3	3	20.3
D7 - Catalog,index and abstract D4 mat'ls	6.86	1	6.86	2	13.72	2	13.72	3	20.58	3	20.58	3	20.58
D8 - Process and edit D7 mat'ls	6.14	1	6.14	1	6.14	2	12.28	3	18.42	3	18.42	3	18.42
D9 - Setup & maintain mat'l dissemntn process	7.57	-1	-7.57	-1	-7.57	-1	-7.57	3	22.71	3	22.71	3	22.71
D10 - Setup & operate a self-eval. system	6.57	-1	-6.57	-1	6.57	-1	-6.57	3	19.71	3	19.71	3	19.71
Organ'stn of an STIS within an IRMS framework	10.0	-1	-10.0	-1	-10.0	-1	-10.0	-1	-10.0	3	30.0	1	10.0
			(-)19.10		59.16		54.93		525.04		605.30		604.17

On the basis of the chosen elements by which the STIS options were judged, model 1 has a negative value. The absence of services caused this result rather than a negative attribute to the services that would be provided. If less service elements had been identified in Table App-5 (or deemed necessary) in the computation of the service factor than the value of STIS, model 1 would not have been negative. The point that is being made is that the value of the service factor is weighed by the importance ascribed to the service elements of Table App-5. If many were to be disregarded, or given different levels of importance, the STIS models 1 - 3 would appear to be closer in service factor value to STIS models 4 - 6.

A further example of the impact of the choice of system service features of Table App-5 in seen in a higher service rating of STIS model 2 (where a manual filing methodology plus a library offers additional services to targeted STIS users) over STIS model 3 (where a microcomputer provides improved data filing and retrieval capabilities but no library service). It can be argued that an on-line search capability is a desired design goal and therefore STIS model 3 should be rated higher than STIS model 2. However, the consensus of FEMA respondents who developed the ratings of service uses (Table App-1 - element A.1) gave on-line search capabilities a rating of only 6.29 (out of a maximum rating of 10), therefore downgrading its value in the computation of the service factor.

Table App-6 presents the comparative values of annual budget, cumulative service factor, and cost/service ratio of each STIS model based on the service of Table App-5. The definition of "cost" used in the calculation

of the cost/service ratio was the annual budget divided by a factor of 1,000. The table shows that the sixth model (Decentralized STIS - Coordinated Network) has the best (lowest) cost/service ratio. The fourth model (Centralized Clearinghouse) has the second best ratio. Though the fifth model (Decentralized STIS - Dendritic Network) has the highest service factor, the cost of operating field sites reduces its cost/service potential to third best.

FIGURE APP-6 COMPARATIVE VALUES OF THE COST/ SERVICE RATIOS OF THE SIX STIS OPTIONS

STIS MODEL	ANNUAL BUDGET	SERVICE FACTOR	COST SERVICE
Option 1 - Referral Service Only	$ 86,000	(-) 19.10	(-)4.50
Option 2 - Referral Service and Library	118,000	59.16	1.99
Option 3 - Stand-Alone Computerized System	128,000	54.93	2.33
Option 4 - Centralized Clearinghouse	467,000	525.04	0.89
Option 5 - Decentralized STIS - Dendritic Network	632,000	605.30	1.04
Option 6 - Decentralized STIS - Coordinated Network	440,000	604.17	0.73

DESIGN OF A

SCIENTIFIC INFORMATION COLLATION AND DISSEMINATION SYSTEM

APPENDIX B

NEEDS ASSESSMENT FINDINGS

NEEDS ASSESSMENT FINDINGS

This section describes the findings of the needs assessment study completed between October 1983 and January 1984. Project staff interviewed 43 potential STIS users or professionals who managed information centers and libraries. The professionals and organizations interviewed during the needs assessment study can be categorized as follows:

1. FEMA Directorates/Regional Offices
2. Specialized Libraries
3. Other STIS Users and Resources

Each category is discussed in detail below.

FEMA Directorates and Regional Offices

Interviews were held in four of the five FEMA directorates and in two of the ten FEMA regions. The initial priority of the needs assessments process was to identify FEMA's current plans for a new hardware environment. At the present time the Agency's ADP needs are being met with a Univac 1108 and a Univac 1100/10. There are about 200 terminals connected to those two systems, 4 to 5 at each region, several at the National Emergency Training Center, several at FEMA headquarters and at a number of FEMA underground facilities. There are usually about 20 active users of the Univac 1100/10 (maximum usage) and 30-35 users of the 1108 (maximum usage). Interviews were held on this subject in the Information Resources Management Office (IRMO) of the Emergency Operations Directorate. A three phased program to improve FEMA's hardware environment was described by FEMA personnel in the Systems Policy Planning and Integration Division of IRMO. Phase I (currently in progress) will upgrade FEMA's main computers to two Univac 1100/61 mainframes. The two new Univacs will allow FEMA to satisfy internal requirements and

will enable FEMA to service the regions and perhaps a few of the states that were not receiving service before. The Phase II (1984-85) element of the upgrade will include the purchase and implementation of a distributed network of minicomputers (VAX) to the regional offices and other FEMA facilities. It is FEMA's intention to develop a distributed data processing network. Phase III will see the implementation of a number of networks, including electronic mail and voice mail.

The Emergency Operations Directorate will be the initial beneficiary of this new automated data processing system. It was made clear, however, that the computer upgrade and the minicomputer network will accommodate the many other requirements from the other FEMA Directorates.

Several specific ADP needs were identified within the Information Resources Management Office. The Economic Analysis Branch within the Computer Management Division of IRMO, for example, cited a continual need for micro-economic information and for data series on the state of the economy. The branch is in the process of obtaining a new data base called Emergency Economic Analysis. This system, when completed, will tie the FEMA regions with headquarters. It will be a query and internal maintenance system that will distribute data to intelligent terminals and will also be capable of doing computer analyses and of acting as a communication link that interacts with dumb terminals. The capabilities of the system will include computerized literature search by key word. The Damage Analysis Branch discussed its needs to keep up to date on changes in the critical industry executive program.

The breath and complexity of FEMA's responsibilities were illustrated via a number of interviews held within the National Preparedness Programs

Directorate. The Office of Resources Preparedness, for example, has four divisions which concern themselves with such issues as stockpiling, rationing, price controls, terms of war, financing war, exporting, national trade, input/output economic analysis, models of production capabilities under mobilization conditions, nuclear damage assessment, industrial mobilization and preparedness. The complexity of these issues underscores FEMA's coordinating role with such other Departments as Energy, Defense, Agriculture, and the Treasury. The Office of Resources Preparedness is illustrative of FEMA's need to be able to access scientific and technical resources and talent in a variety of relevant disciplines.

A conclusion that can be drawn from the interviews held within the National Preparedness Programs Directorate is that the program managers, science and technical personnel, and research staff have many vital linkages to other agencies. Many of these relationships are dependent upon institutional memory and personal networking and therefore need constant attention and updating. It is very difficult for each of the branches, divisions, or offices within FEMA to stay current on all the latest information and material of significance to FEMA's many roles and missions. Even the findings of important research being conducted by certain offices within FEMA are not being adequately disseminated to those who need to know within other FEMA offices. This has serious implications for the effective management of research completed by and for FEMA, as well as for the setting of a long term FEMA research agenda.

The kinds of needs described by the Training and Education Directorate of FEMA were much more of a practical day-to-day matter. For example, the ability to access a variety of experts in different disciplines for instruc-

tional purposes was one specific need that was expressed. Both the National Fire Academy and the Emergency Management Institute would find this capability extremely valuable. The U.S. Fire Administration, on the other hand, receives a great number of inquiries from local fire departments for information on fire related programs, research, productivity improvement, and hazardous materials that they must currently refer elsewhere.

The National Emergency Training Center is developing a closer rapport with schools of public administration at both the undergraduate and graduate level. As more faculty and students of public administration become interested in emergency management, their needs for scientific and technological research, exemplary emergency management programs, and information on local, state, and federal legislation will increase. A specific need identified by FEMA personnel at the NETC was that a clearinghouse function must be able to do more than just refer users. It must also have a capability for interpreting questions and providing specialized research on specific subjects. Since local officials often have trouble fully interpreting their problems, they usually need assistance and further definition before being guided to the proper reference or example program.

The State and Local Programs and Support Directorate indicated a similar need, especially in reference to hazard identification and analysis and the capability assessment portions of the Integrated Emergency Management System. Fundamental to the successful implementation of an integrated emergency management system at the local level is the ability to have access to the relevant scientific, technical, and programmatic information to accurately assess the hazards that a community faces. Similarly, in the

analysis of these hazards, the technical information available via, for example, the Corps of Engineers Boeing Computer System would be of tremendous value to state and local planners. Personnel at the FEMA regional offices also voiced these concerns. Their frustration was due to the inability to adequately supply local emergency program managers with all the necessary information for them to implement IEMS. Although Region IV was actively using the data bases available through the FEMA computer, a nearby local emergency program manager was unable to assess in detail the hazards in her county. She indicated that she lacked the time and the personnel to collect the information on all the potential hazards in her county. Region IV personnel also indicated that when they had traveled to other FEMA regional offices around the country, they found that some regional planners had little or no knowledge of the existence of these data files from FEMA. The following list of data bases are being used by Region IV and would be useful to local emergency management planners. All are currently accessible through files stored in the FEMA Univac.

1. Emergency Management Funding
2. Radiological Defense Offices
3. Radiological Monitors (Trained)
4. Emergency Operating Centers
5. National Warning Points
6. Hardened Radio Stations
7. National Shelter Survey Status
8. Potential Disaster Assistance Centers
9. Distribution of Radiologic Equipment Sets

10. Excess Property Contribution Projects
11. Crisis Relocation Planning Status
12. National Flood Insurance Program Status
13. National Fire Academy Training Records
14. Disaster Expenditures
15. Tornado History
16. Dam Safety Program Status

Other valuable data bases available via other agencies were identified by Martha Williams, University of Illinois, in her recent report to FEMA. These data bases can be of great value if they are accessible by local, state, and regional emergency management planners.

FEMA Region I also identified the need for providing information to state and local agencies. A particularly poignant point was that a locality may be capable of assessing its own hazards within its jurisdiction but would find it extremely difficult without regional or state supplied information to identify these hazards outside of its boundaries (e.g., a dam hazard upstream). The value of supplying state and local agencies with scientific research and technical information was further exemplified by statements made during the November, 1983 hearings before the House Subcommittee of the Committee on Science and Technology, chaired by Representative Albert J. Gore, Jr. from Tennessee. Experts testified that the Spring, 1983 Utah floodings could have been significantly mitigated if modern aerial photography technology had been used in forecasting the amount of run-off from heavy mountain snow. Identical recommendations were also made in

April, 1978 during the Natural Hazards Data Resources Workshop in Boulder, Colorado. That workshop was held to consider the problems pertaining to natural hazards data resources, and to recommend steps which could be taken to improve their availability and usefulness. Professionals from the physical and social sciences attending the conference made nine major recommendations on the collection, storage, and dissemination of scientific and technical resources. These recommendations can be found in the book Natural Hazards Data Resources: Uses and Needs, edited by Susan K. Tubbesing.

The FEMA library personnel in Washington, D.C. and Emmitsburg, MD were interviewed and questioned about their current capabilities in meeting the reference and informational needs of both FEMA and non-FEMA users. The FEMA Washington, D.C. library offers the following services:

- o Reference and research
- o Inter-library loans
- o Circulation services
- o Film library
- o Cataloging of most materials received

These functions are provided by a staff of two. The library has inherited a large number of materials that remain uncatalogued, from various sources such as GSA, HUD and the old Defense Civil Preparedness Agency.

The following relevant materials were identified:

- o State disaster plans (50)
- o Nuclear power plant disaster plans
- o Completed in-house reports

- o Census publications
- o Civil Preparedness Guides
- o Old flood plain reports from HUD
- o Vertical files on fire management from the Office of Public Affairs

The FEMA library at the National Emergency Training Center was found to be meeting the needs of the students attending the National Fire Academy and the Emergency Management Institute. A large number of possibly valuable materials were found stacked in the basement of the library. The NETC library does not actively participate in inter-library loans except through the FEMA, Washington, D.C., library, although they do have a regular exchange of materials with the Center for Fire Research at the National Bureau of Standards.

Specialized Libraries

Four specialized libraries relevant to the roles and missions of FEMA were visited during the needs and asset determination process. The libraries visited were:

1. The National Bureau of Standards Main Library and the Center for Fire Research Information
2. Disaster Research Center, Ohio State University
3. Center for Technology, Environment, and Development (CENTED), Clark University
4. Natural Hazards Research and Applications Information Center, University of Colorado

These libraries were visited because they represented sites with specialized collections not usually found elsewhere.

A review of the assets found at these sites that are relevant to FEMA is discussed below.

The National Bureau of Standards and The Center for Fire Research Information

The National Bureau of Standards (NBS) has a standard reference program that generates high quality data on physical phenomena. The data is used as a basic resource for technical planning and engineering. NBS has five major areas of expertise relevant to emergency management. They are:

- o Building Technology and Fire Research/Investigations
- o Seismic Hazards as they relate to building technology
- o Geotechnical Hazards
- o Radiation Safety Research
- o Basic Engineering Research

NBS works closely with a group of voluntary codes and standards organizations and with testing organizations (e.g. the National Fire Protection Association, the American Society of Testing and Materials, and the American Standards Institute).

NBS holds a unique position in relation to other federal agencies because about 40% of its work is done under contract with these agencies. Part of NBS's mission is to provide technical support to other agencies in areas of NBS expertise. This relationship allows NBS personnel to interact with a wide range of experts from other agencies and the private sector. The NBS also hosts or cosponsors with other federal agencies many technical meetings which further enhances interaction with other professionals in many fields of expertise.

The information system/library at the Center for Fire Research has holdings of about 30,000 items, consisting mostly of technical reports on

fire protection and research. Many of these reports are difficult to find elsewhere. The collection emphasizes the technical basis for solving the fire problem. Some of the reports are available through other data bases but many are not. None of the resources available through the Center are restricted. The Center has a small staff and an on-going and friendly working relationship with the NETC library in Emmitsburg, MD.

The NBS Center has awarded a three year "start-up" grant to Informatics, Inc. to continue the publication of Fire Technology Abstracts as a commercial venture. This publication was formerly a U.S. Fire Administration, FEMA publication.

The Center for Fire Research occasionally (and only by invitation by the local government) researches the technical reasons for a particular man-made disaster. They do not assess who is at fault, but only determine the technical reasons why a failure occurred. They investigate 2 or 3 incidents per year, involving large numbers of people and extensive hours of study. When other organizations like the National Fire Protection Association are asked to do the investigation, an NBS representative may also be part of the investigative team. These types of relationships have made NBS personnel a part of many extensive scientific and technical networks.

Similar professional relationships have been built in the seismic research activities of the NBS Center for Building Technology. For a number of years, building technology groups have initiated field studies in response to requests from disaster sites. Through these field studies they have examined in great detail the functioning of various types of building structures under seismic stress. As a result, they have been able to identify various modes of failures.

The personnel interviewed at the NBS play an active role in the Federal Laboratory Consortium for Technology Transfer (FLC). The Federal Laboratory Consortium for Technology Transfer is the organization that brings representatives from some 300 federal laboratories together for frequent meetings to provide a network for exchanging information and questions between laboratories. Gerry Miller a consultant to FLC recently completed a study for FEMA on the emergency response resources available from the federal laboratories from an emergency perspective. The Consortium has three main functions:

- o Information and guidance for policy makers
- o Services to clients in industry state and local government
- o Training for laboratory representatives in technology transfer

All labs that have a R.D. budget of over $20 million are mandated by federal law to have a full-time technology transfer agent.

The Consortium could be very valuable in the development of a FEMA "talent bank" by serving as the inner circle or starting point in the identification of technically qualified experts in various areas. Within individual labs there may be documents and searchable data bases that may help identify personnel by particular job skills. There is a general data base available on persons involved in technology transfer that is prepared each year by Professor James Jolly of California State University. This data base not only includes the names of individuals involved in technology transfer but also their technical specialty.

It was the opinion of the NBS personnel interviewed that if a talent bank is established it would be best that it be structured as a dual system,

i.e. (1) a listing of particular areas of major concern in which a half dozen experts would be identified and (2) a series of access pathways of technology transfer people who would identify other skills and have access to the broader categories.

Disaster Research Center, Ohio State University

The Disaster Research Center was established in 1963 with a collection of disaster archives from the National Academy of Sciences. The Center has no official organizational status within the Ohio State University and receives no budgetary support. Although it has not been officially announced the Center is moving its entire collection of materials to the University of Delaware this coming year.

The Center has a collection of approximately 12,000 items on disaster phenomena from a social and behavioral perspective. The items can be generally classified as follows:

- o Books
- o Reports and articles
- o Dissertations
- o Primary data

Primary data makes up the vast bulk of the collection. The Center has transcribed approximately 6,000 tapes of original interviews from disaster case studies. Another 4,000 tapes have not been transcribed. These original materials are one-of-a-kind and cannot be found elsewhere. The Center has about 2,000 books, monographs, working papers, articles, and indexes. One index that is published by the Center and that was originally published by the

National Academy of Sciences in 1961, has been updated and contains an inventory of 350 case studies that have been undertaken in the disaster area. The Center has also published an index of Japanese disaster case studies. Finally, the Center has an inventory of approximately 150 doctoral dissertations. Again, many of these are not available elsewhere.

An important part of the Center's work is its international networking. Last year after nearly a decade of work, an international research committee of about 20 social scientists was established and a new journal entitled "Mass Emergencies and Disasters" was published. The Center has a long standing working relationship with the international disaster community. One of the reasons the research committee was formed was to give researchers their own group, their own publications, and their own meetings. There are enough researchers now that this effort ought to be a viable one. When the Center moves to the University of Delaware it will continue to emphasize its relationships with other disaster centers around the world.

The staff at the Center felt that a general strengthening of the profession of emergency management is occurring. They also opined that there is an important need to create an information system to serve these researchers and users. They cautioned, however, that simply creating a system for disseminating information was not sufficient. The objective must be to see that the information is disseminated in a usable form. Another note of caution was expressed about the quality and usefulness of research. Finally, it was felt that FEMA has a very important role and must take the lead in coordinating the establishment of such an information system.

Center for Technology, Environment, and Development, Clark University.

The Center for Technology, Environment and Development (CENTED) at Clark University was established over the past 10 years. Starting with a grant from the Ford Foundation in 1973, several researchers at Clark proposed to look at how different countries were handling the risks of nuclear power. This fueled their interest on the technological hazards question. Since then, CENTED has systematically tracked and collected materials on roughly 100 technological hazards. Researchers at CENTED have done work on comparative risk assessment, on technological hazards, and on the development of risk theory and classification. They have also worked on the ethical issues in risk assessment (specifically radioactive waste management).

The CENTED Library at Clark has a collection of some 3,500 catalogued titles on hazards and approximately 1,500 items on such general subjects as carbon dioxide. CENTED is currently exploring the possiblity of computerizing all the information in their library. Most of the items on the 100 tracked technological hazards are currently located in boxes. These boxes are filled with newspaper clippings, articles, and monographs.

CENTED has extensive organizational relationships nationally and internationally with other risk management programs. The following is a partial list:

- Decision Research, Eugene, Oregon
- Institute of Risk Analysis, Washington, D.C.
- Center for Policy Alternatives, Duke University
- Center for Policy Alternatives, Massachusetts Institute of Technology

- o Center for Environmental Studies, Princeton University
- o Institute for Environmental Studies, University of Toronto
- o Beijr Institute, Stockholm, Sweden
- o Center for the Study of Nuclear Protection, France

CENTED also has an active and on-going relationship with the Natural Hazards Research and Applications Information Center at the University of Colorado. During the past year, these centers have been discussing the feasibility of linking their information dissemination efforts through the publication of a technological hazards newsletter. A prototype of such a newsletter was recently sent to Boulder.

Natural Hazards Research and Applications Information Center, University of Colorado

The Natural Hazards Research and Application Information Center (NHRAIC) was established in 1976. The Center serves as a national clearinghouse for information on natural and technological hazards research and management. There are three basic ways in which the Center disseminates information:

(a) Natural Hazard Observer (newsletter);

(b) Library (inquiries); and

(c) Annual Natural Hazards Research Workshop.

Each of these dissemination components is briefly discussed below:

(a) Natural Hazards Observer - a bi-monthly newsletter received by over 8,000 persons throughout the U.S. and a few countries abroad. The newsletter's purpose is to inform researchers and practitioners about current developments

in the natural hazards research area. The newsletter carries current information on research, discussions of policy related issues, updates of legislation, bibliographic references, recently awarded grants, and discussions of innovative techniques in hazards management practices. It is indexed on an annual basis.

(b) Library - Based on the Center's 1981 progress report, the NHRAIC library possesses or has access to approximately 10,000 items. The Center library today probably contains the largest single collection of natural hazards research information in the world. The kinds of materials available through the library can be roughly categorized as follows:

- o 2,250 bound volumes
- o 3,300 reports, scholary papers, brochures, legislation, etc.
- o 3,500 newsletters, periodicals, news releases, publication lists, professional journals, etc.
- o 110 publications prepared or produced by NHRAIC
- o 30 dissertations
- o 50 publications from the AID Office of Foreign Disaster Assistance
- o approximately 600 relevant volumes and reports available through the Norlin Library at the University of Colorado

The Center receives approximately 200 information and research requests per year from a wide variety of sources. The sources can roughly be broken down as follows:

Federal Agencies	25%
State Agencies	5%
Local/County governments	10%
Research Community	25%

Consultants	15%
Private Sector	10%
International	10%

Most of these information requests require extensive research or access to a wide network of experts. The following are a few typical requests as listed in the Center's 1982 Progress Report.

- o A regional federal official requested names of individuals knowledgeable about psychological impacts of disasters.
- o A researcher requested references to review for a report dealing with the impact of flood insurance programs on coastal development in California.
- o The director of a county emergency service office requested references that would help an emergency manager carry out hazard analyses.
- o A regional planner asked for information on hurricane evacuation in Florida.
- o A federal official requested data that would support the shift from subsidized to actuarial insurance rates in coastal and high hazard areas.

In order to respond accurately to these requests, the Center maintains communication with a large number of researchers, public officials and private organization representatives.

(c) Annual Natural Hazards Workshop - The third dissemination component of the Center is the annual natural hazards workshop which is usually held in July. The workshop is an effort to bring together the whole community of users (researchers and policy makers). Approximately 180 participants attend each year.

In addition to the Natural Hazards Observer, the Center also publishes several other series. They are:

- o The Environment and Behavior monographs
- o The Natural Hazard Research Working Papers
- o The Natural Hazards Information Center Special Publications
- o Annotated Bibliographies

The Center is seriously considering automating its collection this coming year. Much of the information they disseminate and exchange with users is in the staff's memories. This has been seriously taxed by the vast amounts of new information that is received daily by the library. One of the initial steps that will be taken will be to automate their annotated bibliographies by key word.

A serious concern of the staff at the Center is the issue of compatability with other automated library systems. They are hoping FEMA will take a leadership role in coordinating this effort.

The following table, Table 4.1-1, summarizes the holdings and subjects of interest of the organizations visited, including the two FEMA libraries. This table helps point out the vast differences between the resources of the various libraries and information centers that were visited.

Other STIS Users and Resources

FEMA and the National Science Foundation have supported and continue to support a wide array of research on the various aspects of societal response to disaster, hazard mitigation, and recovery. Over the past several

TABLE 4.1-1

SUMMARY OF SITE VISITS

Library Name and Location	Subjects of Interest	Assets	Automated System(s)	Staff
U.S. Federal Emergency Management Agency - Information Resource Management Library Washington, DC	Shelter, support systems, disaster, natural hazards, technological hazards, civil and political disturbances, system evaluations	2,000 volumes 385 films 8,000 prints and negatives	DIALOG	2
U.S. Federal Emergency Management Agency - National Emergency Training Center - Learning Resource Center Emmitsburg, MD	Emergency management, emergency preparedness and training, fire science, fire and disaster research, health, technology, safety	40,000 volumes 320 periodical subscriptions	DIALOG	11
Clark University - Center for Environment, Technology, and Development Library Worcester, MA	Technological hazards, risk analysis and assessment, environment, technological and natural hazards, development	4,500 cataloged volumes 250 serial publications	On-line system, OCLC	2
Ohio State University - Disaster Research Center Columbus, OH	Disaster research, sociology of disaster	500 books 2,300 reports and articles 75 dissertations and theses 7,500 interview transcripts, documents, and newspapers		2
U.S. National Bureau of Standards - Center for Fire Research Washington, DC	Fire research and safety, combustion combustion toxicology, arson, fabric flammability, fire modeling, fire detection	330 books and bound periodicals 22,000 technical reports	On-line system	2
U.S. National Bureau of Standards - Library Washington, DC	Physical sciences, engineering, technology, mathematics	180,000 books and bound periodical volumes	On-line system FEDLINK	32

Library Name and Location	Subjects of Interest	Assets	Automated System(s)	Staff
U.S. Oak Ridge National Laboratory - Libraries Oak Ridge, TN	Chemistry, biology, metallurgy, physics, nuclear science, mathematics, engineering, environmental sciences, ecology	60,000 books 80,000 bound periodical volumes 400,000 research and development reports	DOE/RECON, DIALOG, ORBIT, BRS, The Information Bank	49
University of Colorado - Natural Hazards Research and Applications Information Center Boulder, CO	Natural hazards research and management, natural disasters, mitigation	2,250 bound volumes 3,300 reports, scholary papers, brochures 3,500 newsletters, periodicals, professional journals 110 publications prepared by NHRAIC 30 dissertations and theses 50 AID/Office of Foreign Disaster Assistance publications		2
University of Denver - Department of Sociology Denver, CO	Emergency preparedness, mitigative programs, response and recovery	Dr. Tom Drabek's personal collection of 900 synopses of documents	On-line system	1
University of Pittsburgh - University Center for Social and Urban Research Pittsburgh, PA	Information system on public behavior in crisis situations, risk analysis, risk management, natural disasters, crisis response	6,000 bibliographic listings 250 documents - each of which is computerized by research findings and conclusions Dr. Jiri Nehnevajsa's personal library - 4,000 documents	On-line system	1/2 time person

Library Name and Location	Subjects of Interest	Assets	Automated System(s)	Staff
U.S. Defense Technical Information Center Alexandria, VA	All areas of science and technology	1.2 million reports of Department of Defense research, development, test, and evaluation (includes 2,400 FEMA documents)	Operates the Defense RDT&E on-line system	460
U.S. Department of Commerce - National Technical Information Service Springfield, VA	All areas of government research	1 million titles of U.S. government-sponsored research, development, and engineering reports and other analyses prepared by federal agencies, their contractors, or grantees.	On-line biblio-graphic searches	350

years FEMA has directed its support toward the application of disaster preparedness, focusing its research on practical applications rather than on more theoretical types of research.

In part, the growing public concern about technological hazards and civil defense has emphasized the need for disseminating research to practitioners. A great deal of emergency management related research continues to be funded in the behavioral and social sciences. The following are a few important examples of ongoing research that could be of great value to the practitioner.

- Gary Kreps, William and Mary College in Virginia is completing work on disaster response and planning and is developing a model for a theory of organizational response.
- John Cross, University of Wisconsin, is doing a study of the public's attitudes toward hurricane mitigation measures.
- The Association of Bay Area Governments is doing a study on earthquake hazards that focuses specifically on public official liability for earthquake hazard reduction.
- Peter May, University of Washington, completed a study connected with the Mount St. Helens disaster on the problem of formulating disaster relief.
- The Center for Public Affairs, Arizona State University, has completed important work on seismic hazard mitigation and preparedness.
- Jim Huffman, Lewis and Clark University, is currently doing research on the legal issues related to earthquake hazard mitigation.

The results of this research have important implications for local and state government practitioners. Formulating public policies on emergency management is of growing concern to local and state officials. However, the

ability to access the abstracts of relevant current or past research is extremely difficult. Researchers have found similar difficulties. The project staff visited two universities where the abstracting of research is taking place.

The University Center for Urban and Social Research, University of Pittsburgh, has been developing a qualitative data base on research results dealing with public attitudes and behavior in crisis and non-crisis conditions.

Beginning in 1981, the Pittsburgh research team set out to systematically gather all the materials available under four major categories: civil defense, disaster, attitudes and behavior literature, and literature on behavior under stress. A bibliography of approximately 6,000 documents was identified. Of these 6,000 items, approximately 3,000 could be located. Nearly 300 of the located documents have been read and included in the data base.

The Pittsburgh data base is unique in that it has more than just a bibliographic and abstract function. Two levels of information are given about each document. The first level gives a bibliographic reference, the methodology employed by the researcher, the conceptual or theoretical framework of the research, and other information about the document that communicates what the document is about. The second level of information concerns conclusions. In either the authors own words or in the abstractor's wording, if the author was not clear, the major conclusions of the document are described. The researchers then assign each document a series of different codes that details what they know about the document and describes the conclusions by key word.

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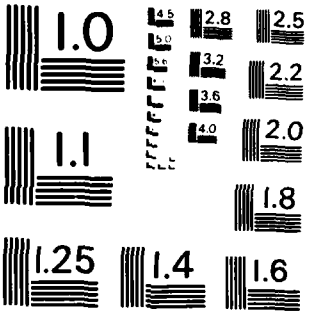

A crucial finding from this particular site visit was the fact that a large number (3,000) of documents are fugitive. Clearly a large amount of valuable research is being lost.

A second systematic literature review is nearing completion at the University of Denver. Dr. Thomas Drabek, Professor of Sociology, has identified and abstracted the sociological literature on disaster research. Building upon the work completed by Samuel Prince in which 190 articles, books, and dissertations on human behavior after a disaster (published prior to 1972) were abstracted, Drabek has concentrated his effort on the literature produced after 1972 and has abstracted nearly 900 items. In both the above cases, the researchers have had a great deal of difficulty physically obtaining the relevant documents. Practitioners who also need to access relevant documents to support their policy formulation would clearly have much greater difficulties in finding the appropriate research.

Finally, the project staff also visited the two major technical information centers where documents relevant to FEMA are being stored. The holdings of the National Technical Information Service (NTIS) and the Defense Technical Information Center are generally described in Table 4.1-1.

The NTIS is a self-supporting service that receives approximately 60,000 reports per year. There are over one million titles in the NTIS data base. This includes contractor reports as well as reports prepared by government employees.

The NTIS also operates the Center for the Utilization of Federal Technology (CUFT). CUFT was established by an act of Congress in 1980 to

assist in technology transfer of government sponsored programs and to respond to requests for technical information. Its goal is to promote exceptionally fine research that has the potential for commercial or practical applications.

A very valuable resource for the STIS, now available through CUFT, is the Directory of Federal Technology Resources. The Directory lists phone numbers, addresses, and contacts of about 800 technology resources and also includes information on information services, facilities for sharing, and the different areas of expertise of the federal libraries.

The Defense Technical Information Center (DTIC) houses the completed contracted work from the Department of Defense and a number of other agencies like NASA and DOE. Approximately 2,400 FEMA documents are stored at the DTIC. An important finding uncovered during interviews at the Center concerned the Center's difficulty in obtaining reports. DTIC receives only about 60% of the reports it should be getting. Considering that the majority of reports sent to DTIC are classified, the fugitive nature of the unclassified emergency management materials is perhaps to be expected.

FEMA's own research tracking system has also been found to be wanting. The Research Development Information System (RDIS) includes citations on research done by contract for FEMA and its predecessor agencies. It files the citations by title, author, and project officer. The new file now being created will also include a description of the work indexed by key word. The FEMA Instruction 7400.1 that established the policy and procedures for including research contracts in the RDIS data base is being compromised

because the term "research" is being avoided by some FEMA offices. To a certain degree, this has led to a loss of management control and direction with regard to FEMA's research and development efforts.

There are large numbers of other potentially valuable resources available to a FEMA STIS. Some are detailed in Martha Williams's report, FEMA Data Base Requirements, Assessment and Resource Directory Model. It would be futile for FEMA to attempt to duplicate the work being done elsewhere. The roles and missions of FEMA are too diverse and complex to attempt such an effort. Clearly, based on the needs and assets determination process, a coordinative STIS model is most suitable.

TABLE 4.2-2

SAMPLES OF LIBRARIES THAT HAVE EMERGENCY RELATED ACTIVITIES

Library Name and Location	Subjects of Interest	Assets	Automated System(s)	Staff
ATOMIC ENERGY (17 total) Rockwell International - Energy Systems Group - Rocky Flats Plant Technical Library Golden, CO	Atomic energy, chemistry, metallurgy, physics	15,000 books and bound periodical volumes 10,000 technical reports 50,000 reports on micro-cards and microfiche	DIALOG, ORBIT, The Info. Bank, DOE/RECON	4
U.S. Department of Energy - Sandia Laboratories - Technical Library Albuquerque, NM	Nuclear weapons, nuclear waste management, nuclear safety and security, electronics, explosives, materials, aerodynamics, solid state physics, ordnance, energy research	40,000 volumes 60,000 technical reports (hard copy) 520,000 technical reports (microfiche)	DIALOG, ORBIT, DOE/RECON, The Info. Bank, DTIC	50
National Lead Company of Ohio Cincinnati, OH	Atomic energy, chemistry, metallurgy	4,500 books 2,000 bound periodical volumes 15,000 technical reports 200,000 microfiche copies of technical reports		1
ATMOSPHERIC SCIENCES (10 total) Mission Research Corporation Technical Library Santa Barbara, CA	Atmospheric physics and chemistry, systems engineering, computer programming	2,000 books 2,000 technical reports 74 bound periodicals 125 microfiche 12 reels microfilm	DIALOG	1

Library Name and Location	Subjects of Interest	Assets	Automated System(s)	Staff
ATMOSPHERIC SCIENCES (con't.) National Center for Atmospheric Research - Mesa Library Boulder, CO	Meteorology, physics, computer science, mathematics, chemistry, oceanography	11,000 books 12,000 periodicals 14,000 hard copy technical reports 20,000 technical reports on microfiche 500 subscriptions	DIALOG, ORBIT	8
U.S. NOAA - Environmental Research Labs - Library Boulder, CO	Mathematics, electronics engineering, atmospheric science, radio physics, oceanography, marine science, astrophysics, cryogenics	34,000 books 20,000 periodicals 36,000 technical reports 52 cubic feet of instruction manuals 260,000 titles on microfiche 100 cassettes (audio) 50 cassettes (video)	Belong to 7 automatic databases	24
CHEMICAL ENGINEERING (79 total) Stanford University - Swain Library of Chemistry and Chemical Engineering Stanford, CA	Chemistry, chemical engineering	27,000 books 250 trade journals and catalogs 580 microfiche 320 reels of microfilm 600 dissertations	DIALOG, RLIN	4
University of Illinois - Chemistry Library Urbana, IL	Analytic, inorganic, organic, physical, biochemistry, chemical engineering	47,130 books and bound periodicals 925 films and microfiche	DIALOG, BRS, NIH-EPA Chemical Information System	5

Library Name and Location	Subjects of Interest	Assets	Automated System(s)	Staff
CHEMICAL ENGINEERING (con't.) Union Carbide Corporation - Library and Technical Information Service Tarrytown, NY	Chemistry, chemical engineering, metals and materials, surface science, catalysis, industrial gases, physics	59,000 books and bound periodicals 2,800 reels of microfilm 700 microfiche 5,400 opaques 500 VF drawers of patents	DIALOG, ORBIT, IFI/Plenum Uniterm Index to Patents	7
CIVIL DEFENSE (1 total) U.S. Defense Logistics Agency - Defense Logistics Services Center Library Battle Creek, MI	Electronic data processing, adult education, management	9,800 books 480 government documents 2,285 reels of microfilm 2,133 microfiche 8,007 research reports		2
COASTAL ENGINEERING (3 total) University of Florida - Coastal and Oceanographic Engineering Department - Coastal Engineering Archives Gainesville, FL	Coastal engineering, Florida beaches, estuarine hydrodynamics, sedimentation, hurricanes, storm surge, tidal inlets, water waves, air-sea interaction	200 books 2,318 technical reports 637 nautical charts 471 maps 1,500 aerial photographs of Florida coast 2,276 drawings		2
COMMUNICATION (60 total) Motorola, Inc. - Government Electronics Division - Technical Library Scottsdale, AZ	Radar, navigation, control systems, digital systems, physics, electronics space science, mathematics	4,500 books 80,000 technical reports	DIALOG, ORBIT	6
U.S. Army Signal Center & Fort Gordon-Conrad Technical Library Ft. Gordon, GA	Communication electronics, computer science, military art and science, leadership, education technology	14,761 books 165 bound periodicals 22,265 documents 2,287 periodicals on microfilm 1,091 microfiche 20 VF drawers of pamphlets/monographs	DTIC	4

Library Name and Location	Subjects of Interest	Assets	Automated System(s)	Staff
COMMUNICATION (con't.) Mitre Corporation - Technical Report Center Bedford, MA	Command control, computer technology, electrical and electronic engineering	125,000 technical reports 50,000 reports on microfiche	DDC	12
COMMUNICABLE DISEASES (9 total) U.S. Center for Disease Control - Bureau of Laboratories - Technical Information Services Library Atlanta, GA	Toxicology, clinical chemistry, vector borne diseases, endocrinology, chronic diseases	3,074 books 900 bound periodical volumes 30,000 citations 175 volumes of journals on microfilm	Computerized cataloging, serials, circulation	5
Nassau County Department of Health - Division of Laboratories and Research - Medical Library Hempstead, NY	Laboratory diagnosis, communicable diseases, pathology, public health	936 books 4,500 microfilmed and bound periodical volumes		2
COUNTERINSURGENCY (3 total) Elgin Base Library - USAF Elgin AFB, FL	Aeronautics, military art and science, aircraft and missile systems, mathematics, management	46,500 books 632 bound periodical volumes 3,205 reels of microfilm 1,250 microfiche 1,058 recordings and tapes 105 video cassettes	DIALOG	7
DISASTERS (3 total) Hall of Flame - Richard S. Fowler Memorial Library Phoenix, AZ	Disasters, fire, fire departments and salvage corps, fire prevention and fire services	4,000 books 300 bound periodicals, company reports, newspaper clippings, photographs of fires		2
American Red Cross - National Headquarters Library Washington, DC	Red Cross volunteer agencies, disaster relief, medicine, nursing, social work	16,000 books and bound periodicals 330 VF drawers of pamphlets, agency materials, clippings and reports 380 reels of microfilm		8

Library Name and Location	Subjects of Interest	Assets	Automated System(s)	Staff
EARTHQUAKES (5 total) California Institute of Technology - Earthquake Engineering Research Library Pasadena, CA	Earthquake engineering, vibration theory, structural mechanics, finite element analysis, seismology, disaster mitigation	8,500 books 1,200 bound periodical volumes 5,000 technical reports 24,000 photos, slides, maps		2
University of California - Berkeley Earthquake Engineering Richmond, CA	Geology, earthquakes engineering-civil, geotechnical, structural; seismology; natural hazard mitigation	14,000 items including 1,925 non-book materials		3
EMERGENCY MEDICAL SERVICES (2 total) American College of Emergency Physicians - Emergency Medical Services Information Center Dallas, TX	Emergency medical services, emergency medicine	2,000 documents 8,000 clippings of journal articles 200 journals	On-line system, computerized serials	2
EMERGENCY PREPAREDNESS (1 total) U.S. General Services Administration - GSA Library Washington, DC	Emergency preparedness, law, engineering, management, architecture, data processing, procurement	120,000 books 3,000 bound periodical volumes 12,000 government documents 2,000 microfilms	The Info. Bank, FEDLINK, DIALOG	9
ENVIRONMENTAL HEALTH (38 total) U.S. Navy - Naval Health Research Center - Walter L. Wilkins Biomedical Library San Diego, CA	Environmental and stress medicine, psychiatry, physiology, biological sciences, social medicine	6,661 books 3,069 bound periodical volumes 1,331 technical reports 50 audio units		2
University of Hawaii - School of Public Health - Reference Room Honolulu, HI	Public health, health services planning and administration, personal health services, environmental health, population studies	14,000 books 1,200 bound periodical volumes 400 reports and theses 1,000 VF items		5

Library Name and Location	Subjects of Interest	Assets	Automated System(s)	Staff
ENVIRONMENTAL HEALTH (con't.) INA Corporation Library Philadelphia, PA	Insurance, management, occupational and environmental safety and health	14,000 books 2,100 bound periodical volumes 70 VF drawer of pamphlets		6
FIRE & FIRE PREVENTION (23 total) U.S. Department of Labor - OSHA - Technical Data Center Washington, DC	Occupational safety, industrial hygiene, toxicology, hazardous materials, fire safety, noise, carcinogens	8,000 books and bound periodicals 100,000 microfiche 2,000 technical documents 3,000 standards and codes	On-line system	12
Velsicol Chemical Corporation - Technical Information Center Ann Arbor, MI	Chemistry, polymer science, fire and flammability	1,200 books 1,575 bound periodical volumes 350 government reports		1
St. Paul Fire & Marine Insurance Company - Loss Prevention Department - Technical Information Services St. Paul, MN	Safety and loss prevention, health hazards, product liability, fire prevention, hospital and medical liability	1,500 books 125 VF drawers of pamphlets, clippings and standards	On-line system	3
FLOOD CONTROL (7 total) University of California - Berkeley Water Resources Center Archives Berkeley, CA	Water resources, development and management, municipal and industrial water uses and problems, reclamation and irrigation, flood control, etc.	42,251 books 29,961 pamphlets 5,076 maps 586 microforms 7,322 manuscripts		5
U.S. Army Corps of Engineers - Galveston District - Library Galveston, TX	Civil engineering, construction and operation of public works for navigation, flood control, recreation, water resources, soil mechanics, law, construction	5,355 books 2,500 other cataloged items		2

Library Name and Location	Subjects of Interest	Assets	Automated System(s)	Staff
HAZARDOUS SUBSTANCES (4 total) Western Montana Scientists' Committee for Public Information - Montana Environmental Library Missoula, MT	Air and water pollution, water resources, energy, fuels, pesticides, herbicides, radiation and hazardous materials, environment, conservation	4,500 books 50,000 reprints 2,000 subject files of newspapers, Congressional Record and Federal Register clippings 19,000 35mm slides		5
HURRICANES (1 total) U.S. NOAA - NOAA/Coral Gables Library Coral Gables, FL	Tropical meteorology, hurricane meteorology, satellite meteorology	2,500 books 2,000 bound periodical volumes 25,000 theses, contractor reports, general reports, maps, etc.		2
LOGISTICS (6 total) U.S. Air Force Institute of Technology - Library Wright-Patterson AFB, OH	Aeronautics, astronautics, physics, engineering, mathematics, economics, chemistry, management, logistics	43,367 books 25,100 bound periodical volumes 640,870 technical reports on microfiche	Computerized serials	14
MECHANICAL ENGINEERING (25 total) United Technologies Corporation - Chemical Systems Division - Library Sunnyvale, CA	Chemical propulsion, chemical technology, mechanical engineering	5,000 books 2,500 bound periodical volumes 25,000 other cataloged items	DIALOG	3
Ingersoll-Rand Research, Inc. - Technical Library Princeton, NJ	Mechanics, materials, mathematics, heavy machinery	5,000 books 200 bound periodical volumes 750 internal reports 6,000 external reports		1
Sperry Corporation - Sperry Marine Systems - Engineering Library Charlottesville, VA	Engineering - electrical, mechanical; computer technology	1,200 books 150 bound periodical volumes 20,000 technical reports 175 volumes of standards 200 patents 970 reels of microfilm		1

Library Name and Location	Subjects of Interest	Assets	Automated System(s)	Staff
MILITARY ENGINEERING (5 total) U.S. Army - Office of the Chief of Engineers - Library Washington, DC	Engineering - civil, environmental military, mechanical; management	40,000 books 2,000 bound periodical volumes 15,000 Corps of Engineers reports	DIALOG, ORBIT	10
NATIONAL SECURITY (2 total) U.S. National Defense University Library Washington, DC	Logistics, management, economics, mobilization, political science, national security, international relations	255,000 books and bound periodical volumes 15 VF drawers 600 linear feet of local history materials	DIALOG, ORBIT The Info Bank	35
NUCLEAR ENERGY (16 total) Westinghouse Electric Corporation Nuclear Energy Systems - Information Resources Pittsburgh, PA	Nuclear technology and engineering	35,000 books and bound periodical volumes 300,000 technical reports on microform 25,000 technical reports and documents 500 videotapes 3,000 pamphlets	On-line system	15
Union Carbide Corporation - Nuclear Division - Paducah Plant Library Paducah, KY	Nuclear science, chemistry, computers, mathematics, statistics, business	10,000 books 7,000 bound periodical volumes 16,000 pamphlets 60,000 documents on nuclear science 32 drawers of microfiche	DOE/RECON	2
POLLUTION (85 total) AMF, Inc. - Technical Information Center Stamford, CT	Chemical engineering, plastics and rubber, analytical chemistry, tobacco, water and wastes engineering/pollution, sports equipment	7,000 books [illegible]0 bound periodical volumes 1,[illegible]00 NTIS reports 30 VF drawers of patents 30 VF drawers of technical reports 15 VF drawers of pamphlets	DIALOG, ORBIT	2

Library Name and Location	Subjects of Interest	Assets	Automated System(s)	Staff
POLLUTION (con't) Iowa State Department of Environmental Quality Technical Library Des Moines, IA	Air and water quality, solid wastes, chemical technology, radiation, administration	2,800 publications of EPA		3
University of North Dakota - Institute for Ecological Studies - Environmental Resource Center Grand Forks, ND	Ecology, land use, water and air pollution, chemistry and biological contaminants, wild life, environmental education, energy, non-renewable resources	1,000 books 100 bound periodical volumes 4,200 cataloged research reports 1,000 environmental impact statements 12 drawers of pamphlets 600 maps		2
PUBLIC HEALTH (76 Total) Denver Public Library - Department of Health & Hospitals Library Denver, CO	Medicine, nursing, public health	2,245 books 4,990 bound periodical volumes 1,000 pamphlets and reprints		2
University of Michigan - School of Public Health - Public Health Library Ann Arbor, MI	Public health - community; environment and industry; biostatistics; toxicology; gerontology; preventative medicine	45,000 books and bound periodical volumes 581 pamphlet boxes	Computerized cataloging and acquisitions	6
Texas Advisory Commission on Intergovernmental Relations - Information Center Austin, TX	Intergovernmental relations, local government finance, public health, regional planning	3,000 books 120 unbound titles		1

Library Name and Location	Subjects of Interest	Assets	Automated System(s)	Staff
RADIATION BIOLOGY (9 total) Lovelace Biomedical and Environmental Research Institute, Inc. - Inhalation Toxicology Research Institute Library Albuquerque, NM	Inhalation toxicology, aerosol physics, radiobiology, biophysics, veterinary medicine, comparative medicine	6,500 books 3,000 bound periodical volumes 2,500 documents on microform technical reports	DIALOG, ORBIT, DOE/RECON, MEDLARS	3
RADIATION EFFECTS (5 total) U.S. Department of Energy - Nevada Operations Office - Technical Library Las Vegas, NV	Nuclear explosives, radiation bioenvironmental effects, geology, hydrology, alternate energy sources	2,100 books 35,000 technical reports 45,000 microfiche of technical eports 4 file drawers of clippings 250 maps		3
RADIATION PROTECTION (5 total) U.S. Food & Drug Administration - Bureau of Radiological Health - Library Rockville, MD	Radiology, radiobiology, radiation, nuclear medicine, radiological health, radiation hazards, emission, microwaves, ultrasonics, lasers	4,500 books 2,500 bound periodical volumes	Computerized cataloging	5
SAFETY (40 total) Cogswell College - Library San Francisco, CA	Electronics, structural and mechanical engineering, technology, industrial and fire safety, architecture	10,000 books 330 journals and other serials		2
National Fire Protection Association - Technical Reference Library Boston, MA	Fire prevention and protection, fire protection engineering and research, arson investigation, fire services management, flammability of materials, model building codes	3,600 books 850 bound periodical volumes 15,000 technical reports 240 filmstrips 8,000 microfiche 180 reels and cartridges of microfilm 254 tapes	DIALOG	3

Library Name and Location	Subjects of Interest	Assets	Automated System(s)	Staff
Wausau Insurance Companies - Library Wausau, WI	Insurance, industrial safety and health	20,000 books 130 bound periodical volumes 185 VF drawers of clippings		5
WASTES, INDUSTRIAL (6 total) Environmental Protection Agency - Environmental Research Lab - Corvallis Library Corvallis, OR	Environmental pollution, water pollution, air pollution, thermal pollution, eutrophication, etc.	2,200 books 6,200 reports 15,000 microforms	Computer-ized cataloging, circulation	3